Phelsuma
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Contents

EDITORIAL

Throughout the first five years of *Phelsuma*'s production we have constantly made alterations to its format. This fifth issue sees three important developments; the inclusion of geographical references to the lists of new publications, the start of our coverage encompassing the Mascarnes islands as well as Seychelles and a paper dealing with the ecology of a whole island. The geographical references in the publications list have been added to increase the usefulness of this section and I am grateful to Prof. D. Stoddart for suggesting this improvement. The expansion of our geographical coverage has been an aim since the publication of the first issue and has now become a reality. It is anticipated that next year's issue will add the Comoros to our range. This expansion not only enhances *Phelsuma* but is also a valuable contribution to the integration of conservation and research in the western Indian Ocean.

To mark the fact that this is the fifth year of production of *Phelsuma* significant space is given over to an update of the main papers in the first issues, these dealt with the ecology and conservation of Silhouette island. Since 1993 there have been many important discoveries on Silhouette and the updated paper publishes many observations for the first time. It is also timely to review conservation on Silhouette as 1997 sees the start of the NPTS Silhouette Conservation Project. It is proposed that papers dealing with specific islands be retained as a regular feature in *Phelsuma* and that the Silhouette paper be followed by summaries of our knowledge of other important, well-studied islands such as Aride and Cousin in Seychelles and Round Island and Île aux Aigrettes in Mauritius. Managers and researchers on these and other islands are invited to share their valuable information with the rest of the western Indian Ocean conservation and research community through *Phelsuma*.

J. Gerlach
Editor

CHAIRMAN'S REPORT

This past year has been a mixture of set-backs and encouraging progress. We found ourselves unable to start the Silhouette Conservation Project on which we had spent so much effort. The building designated by the Islands Development Company to accommodate the project was deemed unsuitable by the IDC and an alternative proposed. This proposal was accepted, but was delayed while new housing was constructed for IDC staff on Silhouette. Their relocation in April 1997 freed the house which was allocated to the project and in May 1997 equipment for the project was moved to Silhouette. In January M. Maunder from the Royal Botanic Gardens (Kew) visited Seychelles to consider the proposal to include Silhouette in the comprehensive Indian Ocean Biodiversity Programme. This will be a joint venture with Kew, Jersey Wildlife Preservation Trust, Fauna & Flora International and the Institute of Biological Control. The NPTS will co-ordinate the project in Seychelles in co-operation with the Division of Environment.

We were accepted as a national NGO member of the World Conservation Union (IUCN) in September last year. This enabled us to attend the first World Conservation Congress in Montreal in October. It was interesting to be involved in the politics of the world's most important conservation body and to make contact with other members. We came away with half a rain forest of publications, pamphlets and handouts for further reference.

Our representation on the Seychelles Islands Foundation board of Trustees was terminated in April 1996 but we remain involved with the work on Aldabra and the Vallée de Mai through representation on the SIF research sub-committee. We have experienced difficulty continuing attendance at the meetings of the National Environmental Council. It may be necessary this year to change our representative if the NEC meetings cannot be rescheduled to outside working hours.

Roche Caiman Bird Sanctuary continued to be our full time preoccupation on Mahé. Vegetation management was stepped up and a project to assist the natural evolution of the area by increasing the area of standing water in front of the hides was agreed. A management group was established and the members have had to deal with steady numbers of breaks in the fence and vandalism in the public hide.

The long-awaited results of the Seychelles giant tortoise DNA analysis became available in January 1997. The unexpected confirmation that there are in fact two extant species of granitic island tortoises came as a pleasant surprise. We plan to set up a captive breeding unit on Silhouette with the aim of increasing the number of individuals and eventual reintroduction. The Seychelles Terrapin Conservation Project started in July 1996 and continued into a second phase in January 1997 and monitoring will continue this year. The very low population and the deteriorating habitats make it important that a captive breeding unit be established as soon as possible. This will secure a permanent breeding population from which marshes legally protected from development can be restocked.

Throughout 1996 our publications were financed through the Special Activities Fund of the Royal Netherlands Embassy. We were able to increase production of "Birdwatch" to 700 copies per issue and "*Phelsuma*" to 300. 2,050

copies of these publications were donated to the Environmental Education Unit of the Education Department and to the newly re-established Scouts movement. As a result of some economies, we were able to use the remaining funds to finance the production of this issue of "*Phelsuma*". The Scientific Committee prepared the first Seychelles Red Data Book which was published in March 1997. Publication was only possible thanks to the invaluable support of James Cadbury, the Chelonian Research Foundation and the Zoological Society of London.

The Royal Netherlands Embassy also funded a path-clearing project on Silhouette. Due to the long delay in our establishment on Silhouette, the path clearing was rescheduled for completion at the end of May 1997. Work got underway from January after an initial rough clearance in 1996. These paths will form the basis for nature trails and will benefit residents and tourists alike.

Without financial support, none of these projects would have been possible and we are very grateful to the following organisations and individuals:

SeyBrew for their continued support for "Birdwatch"

Embassy of the United States of America for funding furniture, computer and laboratory equipment for the Silhouette Conservation Project

Royal Netherlands Embassy for funding publications and the Silhouette path clearing project

Cousine Island Co. for part funding of the tortoise DNA project

Amalgamated Tobacco for general funding

Air Seychelles for reduced rate air tickets

BODCO for a Rs1000 donation

Pool & Patel for acting as our honorary auditors

Environment Trust Fund for new sign boards at Roche Caiman Bird Sanctuary and part funding of the Seychelles Terrapin Project

British Chelonia Group for part funding of the tortoise and terrapin projects

J. Cadbury for part funding the terrapin project and Red Data Book

Chelonian Research Foundation for part funding of the tortoise project and Red Data Book

Zoological Society of London for part funding of the Red Data Book

Dr. J. Steinbacher and Gefiederte Welt for donations and moral support.

For general fund-raising, the Hon. Secretary and Chairman have produced and marketed all essentials from which funds can be raised. Help with fund-raising, suggestions and NPTS promotion by members would be greatly appreciated.

In conclusion, the NPTS has made great strides since its inception in 1992. We are about to embark on some major projects, especially those on Silhouette and the tortoise and terrapin conservation projects. The future of the NPTS depends upon the commitment of its members and supporters. Please help us to keep The Nature Protection Trust of Seychelles at the forefront of conservation in Seychelles.

R. Gerlach (Chairman)

NPTS SCIENTIFIC COMMITTEE

During 1996 the Scientific Committee of the NPTS completed two projects. These were the redrafting of the Silhouette Management Plan and the preparation of the Seychelles Red Data Book. The original draft management plan provided a summary of current knowledge of the flora and fauna of Silhouette with only general management proposals. As a result of contributions from all committee members the new version contains much extended proposals covering all aspects of conservation of the fauna and flora and preservation of important geological features. In some cases, such as marine aspects and many invertebrate groups, proposals remain only general due to a need for basic research. Much greater detail is provided for the plants and vertebrates where a considerable volume of distribution, status and ecological data have been gathered over the last few years. The NPTS is committed to implementing the proposals contained in the management plan.

The Seychelles Red Data Book is the first Red Data Book for Seychelles and was compiled by members of the committee with expertise in the flora and fauna. It has also benefited greatly from unpublished observations provided by a great many naturalists in Seychelles and important data on marine turtles kindly provided by Dr. Jeanne Mortimer. Efforts were made to include all pertinent published data, supplemented with important unpublished information where possible. The committee is grateful to the researchers who have published their data or enabled us to use their unpublished notes. We are especially grateful for observations made over many years by Seychellois professionals and amateurs who have been much neglected in the past. The publication of the Red Data Book in March 1997 was only possible due to the generous sponsorship of J. Cadbury, The Chelonian Research Foundation and the Zoological Society of London. This is one of 90 national Red Data Books world-wide, of which only 30 others include all taxonomic groups; its publication marks a significant stage in the conservation of the biodiversity of Seychelles. It is intended to act as a guide to conservationists, providing up to date information with objective assessment of status using the 1994 IUCN Red List criteria. Measures taken for each species are summarised and practical conservation measures are proposed. The proposition of conservation techniques is intended to suggest measures that can be enacted by both government and independent conservationists to improve the status of threatened species. This is an area where the Scientific Committee's expertise is particularly invaluable as many members of the committee have direct experience of conservation of specific groups and have provided their outstanding expertise for the benefit of conservation in Seychelles.

NPTS Scientific Committee

FREGATE ISLAND INVERTEBRATES

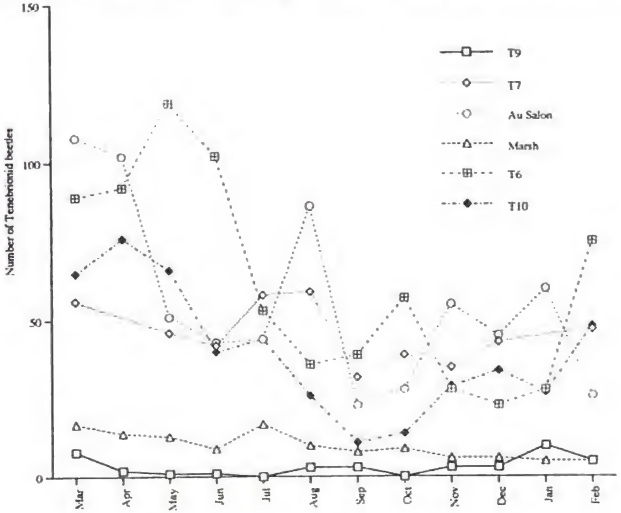
Preliminary results of monthly surveys of *Polposipes herculeanus*

Since March 1996, monthly surveys of species considered vulnerable to rat predation have been carried out on Fregate Island. One such species is the giant tenebrionid beetle *Polposipes herculeanus*, a Fregate Island endemic.

6 woodland stands on the island were chosen. 4 sites (T9, Au Salon, T10 and T6) are areas of *Pterocarpus indicus* woodland ranging in altitude from 5m a.s.l. (T9) to 80m (Au Salon). The Marsh site is a coastal block of *Terminalia catappa* woodland and T7 is an area of *Anacardium occidentale* woodland 30m a.s.l. 20 trees were selected randomly within each site and numbered. Every month, the number of beetles on each tree up to a height of 4 metres were counted.

The figure below shows the preliminary analysis of the raw data for the year as of March 1996. Looking at the data month by month, there appears to be a seasonal variation in abundance with numbers at their highest during the wet north-west season (Nov.-May) and declining in the drier south-east season (June-Oct.). On a site by site basis, there is a marked altitudinal difference in abundance between sites. The lowest altitude sites (T9 and Marsh) both regularly held the lowest numbers of beetles. Higher altitude sites generally held higher numbers of beetles. A more exhaustive analysis of the data will be carried out at a later date.

It is too early to tell whether the rat population is having an effect on the population as there are no baseline data to compare these results against. Monthly variability in numbers, probably due to a range of climatic factors, means that it will be hard to isolate the effects of rat predation immediately. The data should however provide a baseline that can help to identify any downward trends in the long term and provide us with sufficient warning to allow further contingency plans to be put into action. Captive populations of tenebrionid beetles are being maintained at the Invertebrate Conservation Centre at London Zoo. It is hoped that the species can be reintroduced to its former range in Mauritius and Seychelles in due course.



Rob & Vicki Lucking

FREGATE ISLAND INVERTEBRATES

Preliminary report on captive-breeding of Fregate Island invertebrates

For the last few years ZSL's Invertebrate Conservation Centre has been collaborating with the Nature Protection Trust of Seychelles and BirdLife International staff in attempts to clarify the conservation status of Fregate Island's invertebrate species. These efforts have concentrated on establishing ex situ breeding groups of the Fregate beetle *Polposipus herculeanus*, giant millipede *Sechelleptus seychellarum* and enid snail *Pachnodus fregatensis*.

Although we are still in the trial and error stage, results to date have been very promising in the case of the Fregate beetle. Almost all original founder adults have survived and have produced nearly 200 larvae which are growing apace. Only one pupa has been produced so far which unfortunately died, almost certainly due to its soil pupal chamber being too damp. This problem has been rectified and we are hopeful of seeing healthy pupae and subsequent F1 adults shortly. This species has only ever been captive-bred once before at the Natural History Museum by Mr R. Pope in the early 70's when a single F1 generation adult was produced. We have adapted our rearing conditions to include large 'water tanks' filled with a large volume of soil and a central tree trunk to allow climbing and basking.

Our millipedes are now being kept in similar conditions, which will hopefully provide optimum moulting conditions. Although no eggs or larvae have yet been seen the survivorship of the adults has improved markedly. The enid snails have thus far proved the greatest culture challenge. We have divided our founder group between three collections (Wildfowl and Wetlands Trust Martin Mere, ZSL and J. Pedley of the Conchological Society). All three groups have produced numerous egg batches with good hatching results. However, the young snails invariably die and to date we have only succeeded in raising one relatively large juvenile. It is felt that environmental conditions are still not correct for this species and attempts continue to improve matters.

Visitors to the Zoo will be able to see into the specially constructed breeding facility for our Fregate Island species, which is situated in the forest area of the Invertebrate House.

ZSL has also supported the NPTS in gathering environmental data to enhance our ability to care for these species and provided funding for the invertebrate section of the Seychelles Red Data Book. We are grateful for this opportunity to acknowledge the work and advice of Dr J. Gerlach, BirdLife International's Dr N. McCulloch, R. and V. Lucking. The generous support of the John Spedan Lewis Foundation in enabling the construction of our dedicated breeding room for the Fregate Island invertebrates is also gratefully acknowledged. It is hoped that the future of Fregate Island's unique fauna may yet avoid the fate of so many now extinct island species.

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ROCHE CAIMAN BIRD SANCTUARY - 1996

1). Salinity - Salinity was recorded at 1300µ on 7/9/96

2). Vegetation - 1996 records were the grasses *Cynodon dactylon* (L.) Pers. and *Echinochla colonum* (L.) Link, mango (*Mangifera indica* L.) and agati (*Adenanthera pavonina* L.).

Towards the end of 1995, it became apparent that the very saline habitat within the central area of the sanctuary had changed. Where nothing had grown in previous years, clumps of the rush *Typha javanica* Schnitzl. ex Zoll. and *Paspalidium geminatum* Berg grass began to spread. This change in vegetation appeared to be the result of persistent heavy rain during the dry season of 1995 and into the early part of 1996.

It was decided that the rushes be cut and that the grass be sprayed with a systemic herbicide. The herbicide chosen because of its ready availability on Mahé was brand-named "Mamba" (Glyphosate 360g/l - isopropylamine salt [active ingredient]). A 1% solution was applied where recommendations were for 1.5%.

A trial area of *Typha* and *Paspalidium* was sprayed in the first week of May 1996, when there was no longer surface water in the sanctuary. Within four days, the trial area had begun to turn yellow and after seven days, almost all plants were affected.

Cutting of *Typha* began on 12th May and continued on a regular basis until early in July. The final two working sessions involved dragging all the cut *Typha* into an area adjacent to the old scrape and arranging it to form an island.

During the period of cutting, regrowth of *Typha* was sprayed with herbicide. This resulted in a large open area in the centre of the sanctuary. By early December, some patches of *Typha* and *Paspalidium* had re-established themselves and it was decided to spray this central area before the rainy season. Spraying of the same area at least seven days apart proved to be more effective than the previous single application and with the purchase of a second spray pack we were able to keep the central area clear of new growth.

The impossibility of finding an adequate number of voluntary helpers to maintain the cutting and spraying of vegetation prompted a decision to allow the bird sanctuary to evolve naturally. As the bird population had changed over the year from waders to marsh birds (herons, egrets, night herons and bitterns), it was decided that creation of an area of permanent water in front of the hides would be the best course of action. Vegetation management would be confined to the area between the hides and on two sides of the open water, leaving a large area of *Typha* as a natural habitat for reed-inhabiting birds and other animals such as terrapins.

United Concrete Products have offered to excavate the pond using a small tracked digger which is the only suitable machine for the soft, unstable substrate. As soon as the surface mud has dried sufficiently to support the digger, work will start on the project. The spoil from the excavation will be used to create raised islands which are essential during the wet season floods.

3). Invertebrates

3a). Aquatic invertebrates - In September water in the scrape contained ostracods, chironomid and mosquito larvae and a species of small dytiscid beetle.

3b). Insects - Lepidoptera recorded in the grass on 27/7/96: *Syllepta derogata* (Fabricius, 1775) (feeding on *Phyla nodflora* (L.) Greene flowers by day) and *Decadarcis methodica* Meyrick, 1911 (only previous record from Silhouette, 1908).

5 ant species identified from leaf litter samples from Jan. 1992; *Leptogenys maxillosa* (Smith, 1858), *Cardiocondyla emeryi* Forel, 1881, *Strumigenys rogeri* Emery, 1890, *Odontomachus troglodytes* Santschi, 1914 and *Technomyrmex albipes* (Smith, 1861).

3c). Arachnida - A new spider record (27/7/96): *Drexelia bifida* Tullgren, 1910.

4). Vertebrates

4a). Amphibia - Tadpoles of *Ptychadena mascariensis* (Dumeril & Bibron, 1834) were recorded in September 1996.

4b). Mammals - Dogs entered the bird sanctuary on numerous occasions.

4c). Birds - Bird records are summarised below:

Species	J	F	M	A	M	J	J	A	S	O	N	D
Grey plover	1	-	-	0	0	0	0	0	0	-	0	0
Whimbrel	30	-	-	12	12	10	0	0	15	-	0	5
Marsh sandpiper	0	-	-	0	0	0	0	0	1	-	0	0
Greenshank	4	-	-	0	0	1	3	0	2	-	0	1
Wood sandpiper	0	-	-	0	0	0	0	0	0	-	0	6
Common sandpiper	0	-	-	0	0	0	0	0	0	-	0	2
Ruddy turnstone	0	-	-	0	0	0	0	0	5	-	0	0
Little stint	0	-	-	0	0	0	0	0	0	-	0	1
Ruff	0	-	-	0	0	0	0	0	0	-	0	1
Sharp-tailed sandpiper	0	-	-	0	0	0	0	0	0	1	0	0
Grey heron	2	-	-	1	2	2	4	9	3	-	1	1
Purple heron	0	-	-	0	0	0	0	0	0	1	0	0
Green-backed heron	2	-	-	2	3	2	4	0	4	-	0	3
Cattle egret	0	-	-	0	0	0	1	0	0	-	0	1
Little egret	1	-	-	1	2	2	2	1	0	-	1	1
Chinese bittern	1	-	-	0	1	0	0	1	0	-	1	1
Black-crowned night heron	1	-	-	0	2	3	5	4	2	-	3	3
Moorhen	1	-	-	1	3	8	2	0	2	-	1	2
Northern shoveller	1	-	-	0	0	0	0	0	0	-	0	1
Spotted crake	0	-	-	0	0	0	0	0	0	-	0	1
White-winged black tern	1	-	-	0	0	0	0	0	0	-	0	0
White wagtail	0	-	-	0	0	0	0	0	0	-	0	1

Note: No counts were made in Feb., Mar. & Oct. The two Oct. records by R. Scott.

J. & R. Gerlach

NPTS RESEARCH PROJECTS

SEYCHELLES GIANT TORTOISE CONSERVATION PROJECT

The Seychelles Giant Tortoise Identification Project was completed early in 1997 when the results of genetic testing were made available. The DNA analysis carried out by Dr. Les Noble of Aberdeen University's Zoology Department has provided definitive identifications of the taxa surviving in captivity in Seychelles. This analysis has shown that the Aldabran species *Dipsochelys dussumieri* is the commonest species in captivity (97%) but there are also small numbers of supposedly 'extinct' Seychelles giant tortoises (*D. hololissa* and *D. arnoldi*). The confirmation of the survival of Seychelles tortoises has caused considerable excitement in the conservation world, which has been added to by the unexpected discovery that two species survive. On present evidence it appears that Seychelles has only lost one species of giant tortoise (*D. daudinii*). The genetic work has also demonstrated that the wild Aldabran giant tortoises (as represented by samples from Curieuses) show very little genetic diversity when compared to captive Aldabrans. This is due to the population bottleneck suffered on Aldabra in 1880-1920. The current 150,000 wild tortoises are descended from possibly as few as 1,000 animals at this time and are now very inbred. In contrast the captive population includes several lineages that probably date from before the bottleneck. Thus even the Aldabran giant tortoises in captivity are of great conservaiton significance.

Following the confirmation of the survival of Seychelles giant tortoises the NPTS started fund-raising for the second phase of its Seychelles Giant Tortoise Conservation Project. Financial support from private individuals and tortoise conservation organisations has allowed the NPTS to start establishing a captive breeding programme. The NPTS is in communication with tortoise breeders and researchers throughout the world and has received reports of potential *D. hololissa* and *D. arnoldi* in the USA, France and Mauritius and has received requests for identification of tortoises in these countries and South Africa, India, Australian and Italy. These reports will be investigated further over the coming year.

This first stage in the Seychelles Giant Tortoise Conservation Project has been very rewarding and the international interest in, and support for, this project demonstrates the value of through research and proper dissemination of information in furthering the aims of specific projects and of conservation in general.

SEYCHELLES TERRAPIN CONSERVATION PROJECT

The Seychelles Terrapin Conservation Project started in July-Sept. 1996, with a second phase in Jan. 1997. This project to assess the status of the Seychelles terrapins was widely recognised as an important research project and was shortlisted for the 1996 Whitley Award for Animal Conservation, it was funded by J. Cadbury.

The first phase confirmed the presence of *Pelusios subniger* and *P. castanoides* on several islands. Definite identification of both species were made on Mahé, Praslin and La Digue. The Praslin record is the first for *P. subniger* on that island. In addition probable identifications were made from reports of *P. subniger* from Cousin and *P. castanoides* on Curieuse. The present distribution of these

species is *P. subniger*: Mahé, Cerf, Praslin, Cousin, La Digue and Fregate and *P. castanoides*: Mahé, Cerf, Praslin, Curieuse and La Digue. No evidence of the survival of *P. seychellensis* was found and the presence of *P. seychellensis* characters in individuals identifiable as *P. castanoides* raises taxonomic questions.

During the study reports were received that red-eared terrapins (*Trachemys scripta elegans*) had been found in marshes on Mahé. This very adaptable American species has been implicated in declines in native terrapin species in many countries and its presence in Seychelles is a cause for concern. The Seychelles species are threatened by marsh drainage, pollution, the collapse of aquatic ecosystems following invasion by water lettuce (*Pistia stratiotes*) and by predation of eggs, juveniles and nesting females by dogs and cats.

The second phase of research refined initial population estimates, revealing the critical status of both species. There are only 400-450 *P. subniger* and 300-350 *P. castanoides*. These are found in fragmented populations, most of which are not viable in the long-term. The research project collected important data on terrapin ecology which will be published in the near future.

The NPTS is planning to establish captive breeding facilities for both species. Captive breeding will provide the numbers of terrapins required for reintroduction to protected reserves and conservation areas on Mahé, St. Anne, Aride and Cousine. These reintroductions are the only practical means of ensuring the survival of these crictcally endangered species.

J. Gerlach

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[S = granitic islands, Bird & Denis; Ami = Amirantes; Ald = Aldabra]

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Migrant landbirds in Seychelles

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Abstract: Records of migrant landbirds in Seychelles up to 1995 are categorised historically, seasonally and geographically within the country. Observer-related effects probably account for much of the apparent historical and insular variation. Most of the 300 records of 52 species relate to birds which migrate from the eastern Plaearctic to southern Africa, but species from a wide geographical range have been observed. Records of individual species are discussed with particular reference to their known migration routes. Further collection and analysis of records of Seychelles migrants is desirable.

Introduction

It has long been recognised that a wide range of migratory birds occur in Seychelles (Penny 1974; Feare & Watson 1984). Although the islands are remote from any continental land masses, birds from a broad geographical range, including African, Eurasian and Far Eastern species, have been observed. However until recently observations have been sparse and scattered through the literature and the status of many species, particularly landbirds, has been incompletely understood.

With this in mind, the Seychelles Bird Records Committee was established in 1992 to assess the validity of all reports of migrants, including those published prior to the Committee's formation, and of collating and analysing acceptable records. It was felt that a more detailed knowledge of the species occurring, their frequency, seasonality and abundance, would provide a valuable contribution not only to the natural history of Seychelles, but also, given the islands' apparent remoteness from the major migration routes, to migration studies in general.

The purpose of this paper is to summarise the historical, geographical and seasonal distributions of the landbird species so far recorded, and where possible to suggest reasons for their occurrence in Seychelles. The species discussed here are generally those not dependent on sea or fresh water for feeding or nesting. Aquatic, marshland and shore-dwelling species such as ducks, seabirds, herons, other long-legged marsh birds, crakes, rails and waders are excluded. The Committee deals with records of all species apart from Seychelles residents.

Methods of Analysis

Analysis of patterns of occurrence is based on numbers of records, rather than numbers of birds. A sighting of three birds together, for example, is counted as one record, not three. In general, a conservative approach has been adopted in deciding how many separate records have been included in a series of sightings. Numbers of records are as yet too few to allow the fine detail of seasonal patterns to be worked out, so occurrences of most species have been analysed by month. In the case of long-staying birds, only the date when first found is included.

Records refer to birds identified to species, with the exception of the cuckoos *Cuculus*)p. A majority of cuckoo records were accepted as "probably common cuckoo", with a caveat :garding other possible, but less likely, species. In order not to distort the overall picture by mitting these relatively frequent records, "probable common cuckoos" are included with efinite records. Similarly, the one probable Asian lesser cuckoo is included with definite :cords. For most species there has been a high rate of record acceptance. The main exception birds of prey, which are notoriously difficult to identify. To give an idea of the total numbers f birds of prey occurring, the numbers of rejected records of birds of prey for which any records ave been accepted are noted. However they are excluded from tables and figures.

All islands from the Amirantes southwards are classified as "southern", as distinct from ıe northern or "granitic" group, which includes the non-granitic Bird and Denis islands. The)uthern group therefore covers a very large area, and there are almost sure to be differences etween the migrants occurring at, for example, Aldabra and the Amirantes. However, records :e at present too few to allow any more detailed analysis. Most southern records to date are 'om Aldabra. For convenience "spring", "autumn" etc. are used to indicate the seasons in the)rthern hemisphere. Scientific names are given in the individual species notes.

pecies and numbers occurring

Between its formation and the end of 1995, the Committee accepted 300 records of 52)ecies of migrant landbirds. The records are summarised in Table 1. There are 166 records of 6 species from the granitic group and 134 of 26 species from the southern islands.

As Table 1. reveals, the most commonly recorded species are large and/or brightly)loured (e.g. cuckoos, rollers), conspicuous perchers (e.g. spotted flycatcher), open-country :eders (e.g. tree pipit, wheatear), aerial feeders (swifts, hirundines). This suggests that records 're biased towards more easily detected, conspicuous species. There are only seven records of 'arblers, for example. This may not be surprising given the abundance of "cover" for more :cretive species.

listorical distribution of records

Figure 1. shows the number of accepted records per year for northern and southern lands respectively, since 1964 (there are only 13 accepted southern records and two northern re-1964). Both graphs show wide variation in the numbers of records per year. Southern :cords (mostly Aldabra) have declined, with a suggestion of a resurgence since 1990, while ıose from the granitics have been more erratic, though with a distinct and welcome tendency to ıcrease since 1985. These patterns depend almost entirely on the presence or absence of)servers, to the extent that the presence of particular expeditions or individuals at various times ın often be detected.

Table 1. Total number of records of each species

Record	Species
1	Booted eagle, Lesser kestrel, Sooty falcon, Red-footed falcon, Peregrine falcon, Turtledove, Great spotted cuckoo, Brown fish-owl, Nightjar, Little swift, Short-toed lark, Whinchat, Isabelline wheatear, Sedge warbler, Icterine warbler, White-throat, Blackcap, Willow warbler, Lesser grey shrike, Woodchat shrike, Common rosefinch, Ortolan bunting (22 species)
2	Marsh harrier, Pied cuckoo, White-throated needletail, Rock thrush, Wood warbler, Red-backed shrike, Rose-coloured starling (7 species)
3	Eleonora's falcon, Asian lesser Cuckoo*, House martin (3 species)
4	Black kite, Hobby, Blue-cheeked bee-eater, Grey wagtail, Redstart, Golden oriole (6 spp)
5	Mascarene martin
7	White wagtail
8	Sand martin
9	Red-throated pipit
10	Pacific swift
11	Swift, Yellow wagtail
12	Spotted flycatcher
15	Roller
20	Cuckoo (including 14 probable)
27	Broad-billed roller
29	Wheatear
33	Swallow
34	Tree pipit

* includes one accepted as probably this species

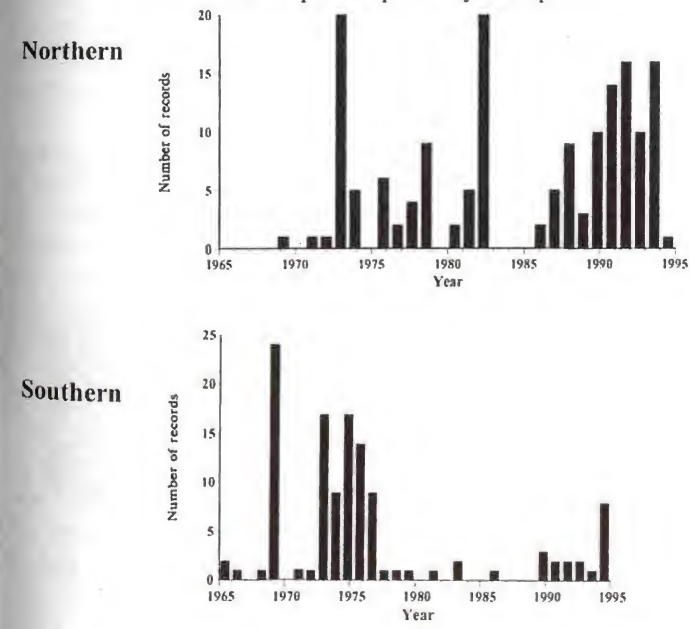

Fig. 1. Number of records per year (NB. 1995 incomplete).

Geographical distribution of records

There are differences between the granitic and southern islands in the relative abundance of species recorded (Fig. 2.). 26 species seen in the granitic group have not been recorded in the south, while only 6 have been recorded in the south but not the granitics. Southern recordes have been even more biased towards a few large and/or conspicuous species than northern ones: the commonest 4 in the south (broad-billed roller, wheatear, swallow and tree pipit) make up 58% of all records, while in the granitics the commonest 4 (cuckoo, tree pipit, swallow and roller) account for only 39%. Some differences are no doubt due to observer-related effects, but some may be real. For instance broad-billed rollers and wheatears are clearly commoner in the south (see species accounts).

Seasonality of records

There are differences between the granitic and southern islands in numbers of records in each month (Fig. 3.). Autumn peaks in both groups may be expected from experience, and are reflected in the seasonal occurrence of individual species, but the large March peak (southern group only) is more surprising. From the comments on historical distribution, this could be due partly to the presence of more observers in spring; in spring 1968 Aldabra was particularly well-watched. Although it is unwise to draw firm conclusions from the limited data, there is a suggestion that March may be generally more productive in the south: the 33 March records here are spread over 6 Marches, compared with only 27 records from 12 Novembers. In the granitics here are only 6 records from 3 Marches.

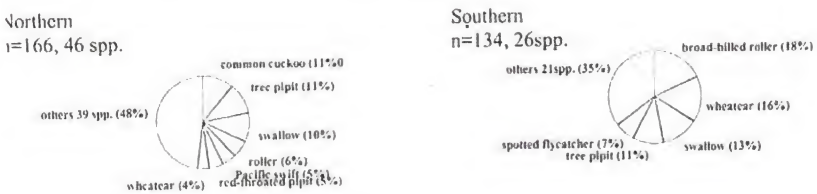

Fig. 2. Species compostion of records

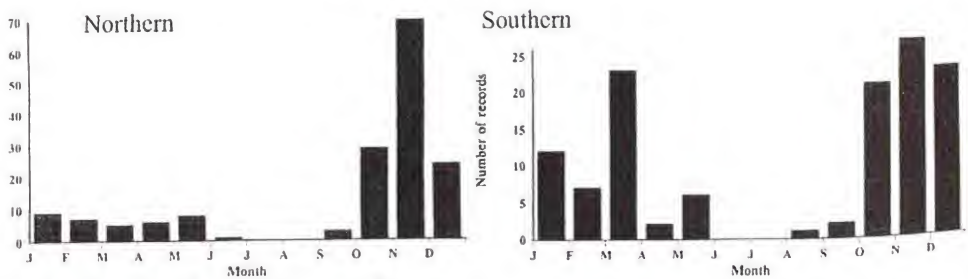

Fig. 3. Number of records per month

Notes on individual species

In this section migrants are divided into groups by their breeding and wintering ranges. Figures below the species name indicate approximate eastern breeding limit (degrees east) of Africa-migrating populations, the southern limit of the wintering range in Africa (degrees of latitude or to the "Cape") and whether any winter also in Asia. Figures on the line below give the number of records for each month in the northern (granitic) (N) and the southern (S) groups. Range and migration data are from Cramp (1977-93), unless stated otherwise.

GROUP 1. - Most Seychelles migrants are Palaearctic-breeding species with African-migrating populations breeding well to the east and with a wintering range in East Africa extending well to the south of the equator. (Some have even more eastern-breeding populations wintering in Asia.) It seems likely that on autumn migration some of these birds may cut across the NW Indian Ocean (Arabian Sea) and be drifted south-east to Seychelles by the NW monsoon. This would explain why migrants are most commonly recorded in Seychelles in October-November.

Marsh harrier - *Circus aeruginosus* (Linnaeus, 1758)
105E; 15+S, + Asia
N: 2 (Jan., Feb.). Also one probable and two unsubstantiated reports. Large raptors, which normally avoid long sea crossings, are rather unexpected, although harriers are known to be less concentrated at short crossings than are eagles or buzzards.

Booted eagle - *Hieraetus pennatus* (Gmelin, 1788)
80E; 30+S, + Asia
N: 1 (Nov.). No other records received. Records of eagles, which normally avoid all but the shortest sea crossings, are very unexpected in Seychelles. Also, most booted eagles migrate via the Bosphorus or around the Black Sea, and Egypt, rather than through SW Asia and Arabia.

Lesser kestrel - *Falco naumanni* Fleischer, 1818
120E; Cape
N: 1 (Apr.). No other records received. In common with red-footed and Amur (eastern red-footed) falcons, more records might have been expected. Falcons will migrate over large expanses of ocean, and this species makes the c2400km crossing of the Mediterranean and Sahara deserts at high altitudes in one flight. It is possible that they regularly cross the Arabian Sea but normally overfly Seychelles.

Hobby - *Falco subbuteo*
c70E?; c25S, + Asia
N: 4 (Jan, Nov., 2 Dec.). Three rejected. Hobbies breed to 160E; the migratory divide at c70E is only suggested (Moreau 1972). They migrate on a broad front and do not concentrate at short sea crossings. There are relatively few observations in the Mediterranean and Iraq, and long, unbroken flights may be the norm.

Eleonora's falcon - *Falco eleonorae* Gené, 1839
c33E; Madagascar + some E. Africa
N: 2 (Feb, Dec.) S: 1 (Nov.; c8 birds, Aldabra 1972). Five rejected. Breeds no further east than Cyprus. All populations migrate via the E. Mediterranean and Red Sea. It is not known where the sea crossing to Madagascar takes place, but they might be expected to occur more commonly in the south.

Sooty falcon - *Falco concolor*
c60E; Madagascar + a few E. Africa
N: 1 (Nov.). One rejected. African migration further inland than Eleonora's falcon, but some pass thorough the Red Sea and Gulf of Aden and are regular on passage in E. Kenya. Commoner than Eleonora's falcon in Madagascar. Recorded at sea in the Indian Ocean off Somalia. Might be expected to reach the Aldabra group.

Peregrine falcon - *Falco peregrinus* Tunstall, 1771
c130E; 30S + Asia
N: 1 (Nov.). One rejected. Also breeds (different races) in E. Africa, Comoros and Madagascar. There is little information about routes or behaviour on migration.

Pied cuckoo - *Clamator jacobinus* Boddaert, 1783
(see below)
N: 2 (Mar., Dec.). Breeds widely in sub-Saharan Africa, probably in S Arabia, SE Iran-Burma. Baluchistan-India race may migrate to S Africa; Arabian records are not of this race, so "passage to Africa may be directly across Arabian Sea/Indian Ocean" (Cramp 1985). Seychelles records strongly support the suggestion of an Arabian Sea crossing; might be expected to be commoner in Seychelles than records suggest.

Cuckoo - *Cuculus canorus* Linnaeus, 1758
c90?E; c30S, + SE Asia
N: 19 (Jan., Apr. 2, May, Sep., Oct. 2, Nov. 7, Dec. 4, "late in year") S: 1 (Nov.) (Including probables). Apparent scarcity in south must be due to observer effects.

Asian lesser Cuckoo - *Cuculus p. poliocephalus* Latham, 1790
c100E; 30S, + India
N: 3 (Jan., probable Nov., Dec.). Given the distribution and the absence of records from Arabia, Iraq or N Africa, it is surprising perhaps that there are not more Seychelles records. Madagascan subspecies *rochii* migrates to Africa, replacing *poliocephalus* after April, and could occur in Seychelles, especially in the south.

Nightjar - *Caprimulgus europaeus* Linnaeus, 1758
10+; Cape, + few specimens in Pakistan
N: 1 (Dec.). Nightjars are common on passage in autumn (though not in spring) in south Iran, Pakistan and NW. India, and there are various autumn ship records off Arabia, indicating the possibility of direct overwater crossing to East Africa. They might be expected to occur more

frequently in Seychelles, but retiring, nocturnal habits and cryptic plumage would make them difficult to find.

Swift - *Apus apus* (Linnaeus, 1758)
120E; 30S, + rarely India, Arabia
N: 6 (Sep. 2, Oct. 2, Nov. 2) S: 5 (Mar., May, Sep., Oct., Dec.), Migration protracted at both seasons, with arrivals in South Africa by September and northward passage still going on into early June; hence our May and September records.

Blue-cheeked bee-eater - *Merops supercilliosus* Linnaeus, 1766 *persicus*
80E; 25S
N: 2 (May, Nov.) S: 2 (Mar., May). There are a scattering of ship records from the Arabian Sea, indicating that some eastern birds make a direct crossing in autumn towards E. Africa. There are also extensive intra-African movements of *M. s. supercilliosus*, which has not yet been identified in Seychelles.

Roller - *Coracias garrulus* Linnaeus, 1758
85E; 25S; irregular S. Africa
N: 10 (Jan., Oct. 2, Nov. 5, Dec. 2) S: 5 (Mar. 3, Nov., Dec.). Apparent seasonal differences between north and south could be due to observer effects. There are ship records in the Arabian Sea and north Indian Ocean, of eastern race *C. g. semenowi*.

Sand martin - *Riparia riparia* (Linnaeus, 1758)
130E?; c25?S, + Asia
N: 6 (Mar., May, Jun., Oct., Nov. 2) S: 2 (Jan., Dec.). Seychelles birds are likely to be from eastern Palaearctic populations, which cross Arabia on migration, migrate furthest south in Africa, and breed late, with large numbers remaining on wintering grounds until late May - hence our May and June records.

Swallow - *Hirundo rustica* Linnaeus, 1758
100E; Cape, + Asia
N: 16 (Jan., Feb., Mar., Apr., May 2, Oct., Nov. 6, Dec. 3) S: 17 (Mar. 6, Apr. 2, May, Sep., Nov. 5, Dec. 2). There has been an almost complete switch of records from the south to the north since 1980, almost certainly due to observer effects. Three of the March southern records are from 1968 (see section on Observer Effects); otherwise there is a distinct peak in November. Records in May and September may refer to birds breeding well to the north-east (see sand martin).

House martin - *Delichon urbica* (Linnaeus, 1758)
90E?; Cape, + Asia
S: 3 (Mar., Oct. 2). More records might have been expected, particularly from the north. However they are very inconspicuous on passage and in winter in Africa.

Yellow wagtail - *Motacilla flava* Linnaeus, 1758
:60+E; Cape, + Asia
N: 6 (Apr., Oct. 2, Nov. 2, Dec.) S: 5 (Feb., Mar. 2, May, Dec.). Very patchy records: all 20th :entury are post-1967; none from S since 1968 (Aldabra); complete absence of records 1973-87 nclusive. More data are needed to check apparent seasonal differences between N and S. The May record (Alphonse) was perhaps a bird from a NE population, which might be expected to nigrate later than W birds.

Rock thrush - *Monticola saxatilis* (Linnaeus, 1766)
120E; 10S
N: 1 (Oct.) S: 1 (Oct.). Might be expected to occur more frequently.

Sedge warbler - *Acrocephalus schoenobaenus* (Linnaeus, 1758)
)0+E; 25+S
N: 1 (Nov.). Fairly frequent in autumn in Middle East east to Oman; might be expected to occur nore frequently. Skulking behaviour makes detection difficult.

cterine warbler - *Hippolais icterina* (Viellot, 1817)
)0E; 30S
N: 1 (Nov.). Birds from the extreme E of breeding range apparently migrate via N Caspian and he Ural valley, and the migration route in Africa is mostly W of Kenya, thus bypassing the ndian Ocean coast. There are a few Arabian records, which may relate to a small Iranian)opulation, the Seychelles bird possibly also originated here.

Whitethroat - *Sylvia communis* Latham, 1787
00+E; c25S
S: 1 (Oct.). Limited extension to Indian Ocean coast in winter. Isolated records to 33S in Cape 'rovince. Migrants from east of the range pass through NW peninsular India in autumn, uggesting the possibility of some passage across the Arabian Sea.

Willow warbler - *Phylloscopus trochilus* (Linnaeus, 1758)
70E; Cape
I: 1 (Nov.). In autumn they tend to pass well to the north and west of the countries bordering the ırabian Sea; in general they are commoner here in spring.

potted flycatcher - *Muscicapa striata* (Pallas, 1764)
15E; Cape
I: 3 (Mar., Nov. 2) S: 9 (Mar. 7, Nov., Dec.). A real spring peak in S (where it is commoner verall, in line with its S centre of distribution in winter) seems possible.

Golden oriole - *Oriolus oriolus* (Linnaeus, 1758)
00E; Cape, + Asia
: 2 (Oct., Nov.) S: 2 (Mar., Nov.). Might be expected to be more frequently seen.

Red-backed shrike - *Lanius collurio* Linnaeus, 1758
90E; Cape
S: 2 (Mar.). Much commoner in spring than in autumn in much of E Africa (100:1 in Somalia) so likely to occur more often in spring than in autumn in Seychelles.

Also in this category, though apparently not wintering in the Indian Ocean coastal zone in East Africa, are:

Western red-footed falcon - *Falco vespertinus* Linnaeus, 1766
120E; 30S; mostly SW Africa
N: 1 (Nov.). It is surprising that there have not been more records, and even more surprising that there have been no records at all of eastern red-footed (Amur) falcon *F. amurensis*, which has been widely assumed regularly to cross the Arabian Sea. Possibly they pass to the north (or south ?) of Seychelles.

Tree pipit - *Anthus trivialis* (Linnaeus, 1758)
70E?; 25S, + Indian subcontinent
N: 19 (Oct. 7, Nov. 10, Dec. 2) S: 15 (Jan., Mar. 2, Oct. 3, Nov. 6, Dec. 3). Not recorded until 1972. Seychelles birds may be easternmost-breeding African migrants en route to/from Africa, but in view of the African wintering range, Seychelles does not appear to be such an obvious transit point for tree pipits as it does for some scarcer species (including some which have not been recorded). Possibly Seychelles migrants originate from around the migratory divide between Indian- and African- migrating populations (approximately north of Seychelles) and migrate more or less due south over the Indian Ocean; winter records, though few, may support this.

Whinchat - *Saxicola rubetra* (Linnaeus, 1758)
90E; 20S
N: 1 (Nov.). Apparently scarce E of Nairobi and on passage in Arabia, Jordan and Iraq, so birds from E of the Caspian probably mostly overfly the Arabian Sea region.

Lesser grey shrike - *Lanius minor* Gmelin, 1788
90E; mostly SW Africa
S: 1 (Mar.). More numerous in spring than autumn in Kenya and Tanzania; in Somalia only spring passage has been recorded; more likely therefore to be recorded in Seychelles in spring (see red-backed shrike).

GROUP 2. - Mostly extending less than 10 degrees south of equator in East Africa

Red-throated pipit - *Anthus cervinus* (Pallas, 1811)
?E; 7S in Tanzania, + Asia

N: 8 (Jan., Feb., Mar., Oct., Nov. 3, Dec.) S: 1 (Nov.). Not recorded until 1975 (see also tree pipit). Breeds W to W. Alaska, E birds migrating to SE Asia; position of migratory divide not known. Heavy passage in the Middle East, but it is scarce from Iran to India. Scarce S of equator in winter, and less common close to Indian Ocean coasts. Crossing the Arabian Sea seems less likely than for some other species. The single southern records is from the Amirantes.

Grey wagtail - *Motacilla cinerea* Tunstall, 1771
c55?E; 10S, + Asia
N: 3 (Nov.) S: 1 (Oct.). Does not winter up to the Indian Ocean coast. Also winters Arabia and India (and further eastern birds in SE Asia and beyond). As with tree pipit, it is possible that Seychelles birds may have migrated approximately due south from near the position of the divide between Africa- and Asian- heading populations.

Wheatear - *Oenanthe oenanthe* (Linnaeus, 1758)
170W; 10S
N: 7 (Jan., Feb. 2, Oct. 2, Dec.) S: 22 (Jan. 10, Feb. 6, Mar. 4, Dec. 2). E. Siberia (170W) birds migrate to E Africa. In Seychelles evidently commoner in S. The winter peak is not due simply to observer bias and is shown by both S and N records. Whether they are winter residents or undertake within-winter movements is not clear. Aldabra is close in latitude to the normal S limit of the wintering range.

Blackcap - *Sylvia atricapilla* (Linnaeus, 1766)
30E; 10S
N: 1 (Dec.). Barely reaches as far east as the Indian Ocean in Africa. Apparently uncommon on passage in Arabian, but very common in North Yemen, so some eastern breeding birds may take a fairly southward bearing.

GROUP 3. - The remaining Palaearctic-African migrants are on the face of it less obvious candidates for vagrancy to Seychelles

Turtledove - *Streptopelia turtur* (Linnaeus, 1758)
00+E; 10N
S: 1 (Dec.). Apparently does not winter much S of 10N, and only vagrant to E Africa. Might be expected that *arenicola* from the E population (breeds to 100E) would be more likely to occur, but the Aldabran specimen was thought to be of the N/W race *turtur* (Frith 1974). However Cramp (1985) states that some C Asian *arenicola* are indistinguishable from *turtur*. In any case there would seem to be no need for even E birds to approach the Arabian Sea to reach their wintering area.

Great spotted cuckoo - *Clamator glandarius* Linnaeus, 1758
5E; 10N?

N: 1 (Oct.). Breeds only as far east as the Iran/Iraq border; also breeds widely in Africa. Although it has been suggested that northern, possibly Palaearctic, birds might migrate as far south as Kenya and Tanzania (Britton 1980) there is as yet no good evidence for them further south than 10N. However the October date of the Seychelles record (a juvenile) seems to indicate northern origins.

Little swift - *Apus affinis* (Gray, 1832)
see below
N: 1 (Dec.). Scarcely migratory over most of its range. NW African population apparently winters within the breeding range and/or Sahel area. Some movements within the Afrotropics and the Indian subcontinent. Probably partly migratory in the Near East and N Middle East (i.e. Turkey-Iran area); wintering areas unknown. Similarly, a summer visitor to Tadjikistan, Uzbekistan and Turkmeniya, but "not known whether these winter in Africa, Arabia or India" (Cramp 1985).Our record (of one or two birds) is probably from these more migratory populations.

Short-toed lark - *Calandrella brachydactyla*
115?E; mostly 14+N, + Asia
N: 1 (Nov.). Winters in Africa mostly north of the Sahara, also central Arabia, SW Asia, northern India, etc.

White wagtail - *Motacilla alba* Linnaeus, 1758
c80?E; mostly equator, + Asia
N: 5 (Jan., Nov. 2, Dec.) S: 2 (Mar., Nov.). Few cross the equator, but straggles to Malawi. Some of the population from the Urals-Yenisei area (*M. a. dukhunensis*) winter in East Africa, as well as from N. India to Arabia.

Redstart - *Phoenicurus phoenicurus* (Linnaeus, 1758)
100E; N of equator, + some Arabia
N: 4 (Oct., Nov. 3). Winters mostly down the Nile valley and in scrub/savannah belt on either side (i.e. not to the Indian Ocean coast), at c9.5-15.5N. However, occurs sparsely in Kenya, extends to c2N in E. Zaire and Uganda. *P.p. samamicus* from Caucasus and northern Middle East winters in Arabia as well as Sudan and Ethiopia.

Isabelline wheatear - *Oenanthe isabellina* (Temminck, 1829)
120?E; c. equator, + Asia
N: 1 (Nov.). Although there are few records south of 4S in Tanzania it is regular on passage in coastal lowland Kenya (outside the main wintering range). Common to very common on passage in the Middle East, and has been recorded from ships in the Red Sea and on Socotra (c300km NE of Somalia).

Wood warbler - *Phylloscopus sibilatrix* (Bechst., 1795)
90E; 6S, mainly W of 35E

N: 1 (Nov.) S: 1 (Dec.). Although the vast majority evidently winter well to the west, there have ecently been wintering records in southern Somalia, and there are a few records from Kenya. Scarce but widespread on passage in Arabia, and has been recorded from northern Iran; these birds may be linked to these east African wintering areas and would seem likely to be the source of the Seychelles records.

Woodchat shrike - *Lanius senator* Linnaeus, 1758
50E; N of equator, + few SW Arabia
N: 1 (Apr.). Scattered records to 1S, not wintering to Indian Ocean coast. Unlike other shrikes ecorded in Seychelles, spring and autumn routes are similar. Fairly common in Arabian spring Feb.-Apr.) but probably normally overflies in autumn.

Ortolan bunting - *Emberiza hortulana* (Kaup, 1829)
00E; N of 5N, + few S Arabia
N: 1 (Nov.). South of c10N, apparently winters only in the Ethiopian Highlands. There is one ecord from Kenya almost on the equator in mid-October. Vagrant to India and Pakistan in spring.

GROUP 4. - Palaearctic breeders not thought to migrate to Africa at all:

Brown fish-owl - *Ketupa zeylonensis* (Gmelin, 1788)
N: 1 (Nov.). A remarkable record of a species which breeds in the Indian subcontinent, ndochina and South China, with a tiny population in the Middle East, and for which there is no vidence of any migration at all. Arrival in Seychelles aboard a ship must be a strong possibility.

White-throated needletail - *Hirundapus caudacutus* (Latham, 1801)
N: 2 (Oct., Nov.). Breeds from central Siberia east to Japan, wintering in Australia. Not ecorded in India, so more western populations must migrate SE/E in autumn, north of the main nountain ranges. Seychelles birds were well away from normal migration routes, but it is a well-nown wanderer, with records in Europe and Fiji.

Pacific swift - *Apus pacificus* (Latham, 1801)
N: 8 (Jan., May 2, Oct. 2, Nov. 3) S: 2 (May). Migratory nominate race breeds from Siberia to N China and Japan, wintering in Indonesia, Melanesia and Australia. There are a few records from N India. This is another great wanderer, with records from W Europe. The only species recorded at all frequently in Seychelles which is not thought to winter in Africa - in fact more requent than some apparently more likely species. The Seychelles records suggest the ossibility of a regular passage to and from unknown wintering area, perhaps in Madagascar or Africa (Cramp 1985). They arrive back in Mongolia and Siberia mostly in May.

Rose-coloured starling - *Sturnus roseus* (Linnaeus, 1766)
N: 2 (Oct., Dec.). Breeds from Balkans/Black Sea east to c90E; winters in India, with small numbers in Oman. well-known as an irruptive wanderer across Europe.

Common rosefinch - *Carpodacus erythrinus*
N: 1 (Oct.). Breeds patchily from N Europe and N Turkey to W China and the Lena Basin (160E). The breeding range has recently expanded rapidly westwards. Winters in S and SE Asia from Pakistan eastwards, with a few in E Israel, Oman and Sinai. It has been suggested that some apparently off-course autumn migrants may be seeking new winter quarters in S Europe.

GROUP 5. - The remaining records are from non-Palaearctic breeding populations

Black kite - *Milvus migrans* (Boddaert, 1783)
S: 4 (Aug., Oct., Nov., Dec.) Two rejected records. All four records were of the African race *M. m. parasitus* which is migratory within Africa.

Broad-billed roller - *Eurystomus glaucurus* (Müller, 1776)
N: 3 (Feb., Nov. 2) S: 24 (Mar., Oct. 9, Nov. 6, Dec. 8). All subspecifically identified birds have been of the Madagascar-breeding race *E. g. glaucurus*, which breeds Oct.-Mar., "wintering" in Africa Feb.-Nov., mostly in the E. Zaire savannahs (Fry *et al.* 1988). Seychelles records presumably relate mostly to birds on returning to Madagascar. Certainly commoner in southern islands, as expected for this range.

Mascarene martin - *Phedina borbonica* (Gmelin, 1788)
N: 1 (May) S: 4 (Oct. 2, Nov. 2). The May record on Bird is interesting, but perhaps less unexpected for this non-Palaearctic migrant.

Conclusion

There are no really commonly-seen migrant landbirds in Seychelles; not even the most frequently recorded species have yet accumulated 50 records each. This is no doubt partly due to the sparse and erratic nature of observations and documentation up to the very recent past (Fig. 1.), but must also be due to the islands' remoteness from the nearest land masses and main migration routes. The granitic group in particular are over 1000km from the nearest continental land mass.

However, some birds are now known regularly to undertake very long-distance, non-stop flights over oceans, and a few species probably pass through Seychelles every year, albeit in very small numbers. For example since 1968 broad-billed rollers (likely to be very under-recorded from Aldabra) have been recorded in about 30% of years, tree pipits in 50%, wheatear 60% and swallow 70%. It is possible that Seychelles lies on the normal migration pathway of some populations of these and perhaps other species.

On the other hand, there are some birds known or suspected regularly to cross the Arabian Sea/Indian Ocean (eg. Amur (eastern red-footed) falcon, red-footed falcon, Asian lesser

cuckoo and pied cuckoo). It seems surprising that these species have not been recorded more frequently. They could genuinely be as scarce in Seychelles as they appear to be, but might perhaps also have been overlooked.

Several other species which have not yet been recorded might be expected, on the basis of their breeding and wintering distributions, to occur. Among the most likely candidates are: bee-eater *Merops apiaster*, rufous bush chat *Cercotrichas galatotes*, thrush nightingale *Luscinia luscinia*, nightingale *L. megarhynchos*, white-throated robin *Irania gutturalis*, pied warbler *Acrocephalus scirpaceus*, great reed warbler *A. arundinaceus*, olivaceous warbler *Hippolais pallida*, Upcher's warbler *H. languida*, garden warbler *Sylvia borin* and Isabelline shrike *Lanius isabellinus*.

At present we have very little idea about what factors bring landbirds to Seychelles. It is often assumed that the NW monsoon may "drift" migrants across the Arabian Sea, but there are no quantified weather data to support this hypothesis.

It has become clear from the work of the Records Committee that in Seychelles, on the cross-roads between Africa, India, Madagascar and South-west Asia, virtually any migrant can occur. Birdwatchers in Seychelles should be aware that it is worth looking for migrant landbirds, especially less conspicuous species. It will remain impossible to draw firm conclusions about the real status of these migrants in Seychelles and their movements to and through the islands until more data are amassed. With this in mind, the Records Committee will be continuing to assess and document records of all migrant landbirds for the foreseeable future.

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The ecology and conservation of Silhouette island

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Abstract: The ecosystems of Silhouette island are described with summaries of the fauna and flora. These show that Silhouette is one of the most important biodiversity hotspots in the western Indian Ocean. It is exceptionally well preserved and data are presented on forest regeneration. The island is the subject of a conservation project by The Nature Protection Trust of Seychelles.

Introduction

In recent years the fauna and flora of Silhouette island, Seychelles have been reported on in numerous publications. Research into the status of its biota began with the explorations of Brauer in 1896 and the Percy Sladen Memorial Expeditions of 1905 and 1908-9. These were followed by a small number of brief surveys for specific groups such as the Lepidoptera collected by Legrand in 1956 and 1958-9. The recent upsurge in research on the island began with the Oxford University Silhouette Expedition in 1990 and has been followed by semi-annual research projects by The Nature Protection Trust of Seychelles, researchers working in conjunction with the NPTS and a small number of independent studies.

The state of knowledge of the island was discussed in 1992 in two papers summarising data on the flora and fauna of Silhouette (Gerlach 1993). In the 5 years after these publications there have been many new discoveries and developments in our scientific understanding of the island and its conservation status. The account below provides updated coverage of the island's ecosystems and conservation based on recent reports (mainly OUSE 1990 and NPTS 1996) and unpublished data. Full species lists for the island are given in the accompanying supplement, including authorities (which are not repeated here).

Summary of the physical aspects of the island

Silhouette is the third largest of the granitic islands at 1995ha. It is the second highest (740m) and this combination means that it supports almost all natural habitats found in the islands. Geologically it is somewhat distinct from the other granitic islands, with perhaps the exception of North island (Stephens 1996), being volcanic in origin with rocks dating back approximately 63 million years, some 90 million years younger than the other islands. The relatively young age of the island results in it retaining a more rugged topography than most other islands. This means that there are numerous steeply sloping valleys and boulder fields, characteristics that have been of major significance in the preservation of the island's biota.

Fig. 1. Composite aerial photograph of Silhouette island

At altitudes above 450m above sea level cloud cover is almost permanent, resulting in a high mean relative humidity (93% during July-Sept. 1990) and low temperatures (18-26°C). Despite the cloud cover and the high humidity high valleys such as the Anse Mondon valley are sheltered from direct rain by the adjacent peaks. No records of rainfall have been made but observations indicate that rain falling on Mt. Pot à Eau and Jardin Marron rarely affects adjacent valleys.

The substrate of most of the island is a shallow humus soil covering large granite boulders. Typically valley heads slope steeply and this steepness and the boulder substrate have prevented the development of significant layers of humus or soil. The areas of leaf litter that have accumulated in the valleys do cover some small pockets of soil with a pH of 6.0-6.5. This slight acidity is probably due to the high leaf litter content and the acidic processes of organic decomposition.

Marine life

No studies of the marine life of Silhouette have been carried out. There are 10km of fringing reef (including 5km of reef flat) and 7km of exposed rocky shore. Sea grass beds are restricted to patches on the reef flat.

Flora

Of the 195 angiosperm species recorded on Silhouette, 11% are probably introduced, 34% of the 174 native species are Seychelles endemics (2% endemic to Silhouette). As noted previously, Silhouette supports all the major habitat types in Seychelles with the exception of *Pisonia grandis* forest. The approximate areas covered by each habitat are shown in Table 1. The most important of these is the unique *Pisonia sechellarum* forest. This is a well defined area characterised by the dominance of *Pisonia sechellarum*. This tree is not found outside the forest which is defined as the area enclosed by a line uniting all the outlying *P. sechellarum* trees. In this area of 0.48ha 37% of the trees are *P. sechellarum*. Although this is only the second most abundant tree species in terms of the number of individuals its dominance is shown by its contribution to the canopy cover (see Table 2.).

Of the 59 plant species recorded in the *Pisonia* forest several are either restricted to the forest or have very limited distributions outside it. These include *Psychotria silhouettae* (only 5-6 plants in the Anse Mondon valley). *Pseuderanthemum tunicatum* and *Piper* sp. are more abundant but similarly restricted. *Acacia pennata* is also found near Gratte Fesse. *Achyrospermum sechellarum* and *Schefflera procumbens* were originally described from Mahé; both are now restricted to Silhouette (Anse Mondon valley, Mon Plaisir and Gratte Fesse and *Pisonia* forest, Morne Dauban, Mon Plaisir and Gratte Fesse respectively). There are no identifiable correlations between the abundance of any of the plant species, or between the plants and microhabitat factors within this area but the valley's sheltered microhabitat probably contributes to the site's remarkable flora.

Many of the plants share a high potential for asexual reproduction. *Pisonia sechellarum* trees reach a maximum height of 25m at which level they fall over as a

Table 1. Habitat areas on Silhouette

Habitat	Area (ha)	Habitat	Area (ha)
Littoral	4.0	Glacis	112.0
Open marsh	4.6	Mid-altitude forest	351.4
Mangroves	7.5	Palm rich forest	1087.5
Suburb	17.6	*Dicranopteris linearis* scrub	70.3
Casuarina habitat	1.5	*Clidemia hirta* scrub	2.3
Dry coastal forest	5.7	*Cyathea sechellarum* scurb	0.7
Mixed coastal forest	92.2	*Pisonia sechellarum* forest	0.5
Coffee plantation	8.4	Mist forest	215.3
Rubber plantation	7.4		

Table 2. Trees species in *Pisonia sechellarum* forest

Species	Composition		Species	Composition	
	trees	canopy		trees	canopy
Cinnamomum verum	42%	0	*Pandanus sechellarum*	2%	0
Pisonia sechellarum	37%	55%	*Northea hornei*	<1%	7%
Ficus bojeri	13%	9%	*Ficus lutea*	<1%	1%
Verschaffeltia splendida	2%	2%	*Paraserianthes falcataria*	<1%	0
Trema orientalis	2%	0	*Syzygium carophyllum*	<1%	0
Grisollea seychellarum	2%	0	open	-	26%

result of stresses upon the shallow roots and the soft wood. The fallen trunks continue to grow, developing new stems, a process that also occurs along exposed surface roots. This continuous cycle of growth and collapse followed by regrowth results in many apparently separate trees being found to be connected to a single main stem (at the most extreme one surface root supports 12 major trunks). This is a feature shared with the only other arborescent *Pisonia* found in Seychelles, *P. grandis*. *Hypoxidia rhizophylla, Achyrospermum sechellarum, Pseuderanthemum tunicatum, Psychotria silhouettae, Begonia sechellensis, B. ulmifolia, Procris insularis, Dracaena reflexa, Alophyllus pervillei, Pogostemon hyeanus, Clidemia hirta,* the strangling figs *Ficus bojeri* and *F. lutea* and the ferns *Bolbitis* sp. and *Asplenium* aff. *tenerum* grow by similar systems of nodal rooting and runners in addition to the creepers *Piper* sp., *Acacia pennata, Merremia peltata, Schefflera procumbens, Flagellaria indica, Tylophora coriacea* and *Adenia gummifera*. Stilt roots on *Pandanus sechellarum* and *Verschaffeltia splendida* may also be adapted to solving the problems caused by growth on steep rocky slopes. Of the higher plants in the forest 61% have some form of supporting growth described above.

With 550 trees over 1.5m tall per hectare there are an estimated 190 *Pisonia sechellarum* trees. Their density decreases towards the lower end of the forest where they are replaced by *Ficus bojeri*. *P. sechellarum* height also decreases from 22.7m to 13.1m. The reasons for these changes are not clear. Tree number is not correlated with the slope of the ground (Spearman's rank corrected for tied data: r=0.063 (all species), r=0.283 (*P. sechellarum*); P>0.2).

Important areas include the Morne Dauban moss forest, extensive glacis areas, lowland marshes and the lowland forest to the south of the island. This area has not been explored thoroughly and is the only significant area of primary lowland forest known to survive in Seychelles. It was maintained as a reserve in the early 1900s (Gardiner 1910). From the observations made to date no introduced trees have been planted deliberately and invasion appears to be very restricted. This is one of very few lowland sites in Seychelles where coconuts, *Cocos nucifera,* are restricted to their natural littoral fringe. A smaller area of similar forest is present at La Reserve/Grebeau. These areas are important for the presence of natural stands of rare species such as *Carissa edulis* and has been the source of much of the seed of *Mimusops seychellana* planted on Mahé and Praslin (H. Dauban *pers. comm.*).

An important habitat present on Silhouette is Coco-de-Mer (*Lodoicea maldivica*) forest. The 0.4ha forest at the source of the Grande Rivière at Jardin Marron contains 21 Coco-de-Mer planted in the 1940s. This is an un-natural habitat for Silhouette as this palm is naturally restricted to the Praslin group. However, it is of conservation value as the only wild reproducing population species outside of Praslin and Curieuse. In terms of flora and associated fauna it is not significantly different from natural palm forest and thus does not pose any conservation problems. Several female trees are fruiting and first nut fell in late 1996.

Silhouete is the only island to retain coastal marshes free from introduced species except for the fish *Oreochromis mossambicus* (tilapia). This was first introduced to Mahé (Baie Ternay) in the 1960s by Veevers Carter.

Fauna Silhouette supports an exceptionally diverse fauna due to the varied topography, wide habitat range and relatively intact flora. To date 1303 species have been recorded, of which approximately 1280 (98%) are native. Of these 907 (71%) are Seychelles endemics, 281 (31%) recorded only from Silhouette. The fauna is summarised in Table 3.

Table 3. Terrestrial animals recorded on Silhouette

Group		Species		% natives endemic to	
		Total	Native	Seychelles	Silhouette
Nemertea		1	1	0	0
Annelida	Hirudinea	2	2	100	100
	Oligochaeta	1	0?	0	0
Mollusca		37	34	70	21
Chelicerata	Schizomida	1	1	100	0
	Arachnida	80	80	75	23
	Opiliones	8	8	100	13
	Pseudoscorpiones	4	4	100	0
	Scorpiones	1	1	100	0
	Amblypygi	1	1	0	0
	Acari	13	13	92	69
Crustacea	Decapoda	10	10	0	0
	Isopoda	13	13	85	8
Myriapoda	Diplopoda	16	16	94	6
	Chilopoda	8	8	75	13
	Symphyla	1	1	?	?
Apterygota	Thysanura	6	6	100	0
	Collembola	6	6	100	0
Insecta	Odonata	11	11	45	18
	Orthoptera	32	32	81	16
	Dictyoptera	18	17	71	6
	Isoptera	2	2	100	50
	Dermaptera	12	9	44	22
	Hemiptera	122	122?	72	18
	Psocoptera	64	64?	97	9
	Thysanoptera	11	11	100	89
	Siphonaptera	1	0	0	0
	Neuroptera	3	3	0	0
	Lepidoptera	181	177	54	19
	Trichoptera	1	1	100	0
	Diptera	94	94?	68	61
	Hymenoptera	111	107	79	30
	Coleoptera	387	383	73	18
Chordata	Pisces	5	4	25	0
	Amphibia	12	12	92	0
	Reptilia	15	13	92	0
	Aves	16	14	43	0
	Mammalia	4	2	100	0

Most are small leaf-litter inhabiting invertebrates. The lowland species are predominantly pantropical or western Indian Ocean species whereas the high-altitude species are almost all Seychelles endemics, very often Silhouette endemics. These endemic taxa are isolated in the high valleys where leaf litter fauna is restricted to small pockets 1-15cm deep, which cover only 25% of the ground. This is the only site in Seychelles where fully detailed studies have been carried out and the recorded animal densities are shown in Table 4. Collembola are not listed as these have not been sampled. The data for mites are not accurate due to difficulties in field sampling. The only mites to be sampled reliably are the giant Holothyridae.

At present there is little reliable information on the distribution of the different animal species on Silhouette. Distribution records indicate that the greatest levels of diversity are found on Mont Dauban and at Mare aux Cochons. This may be due, in part, to collection work having concentrated on these areas. Detailed taxonomic work on the molluscs demonstrates that several species are restricted to very small areas of mist forest and that the climatic cline is a major factor in speciation (Gerlach 1995b) which may indicate that the high, wet centre of the island is the most diverse. The southern part is virtually unexplored; from the sea it appears to contain numerous isolated valleys and may include important centres of biodiversity. It is expected that the lowland forest 'reserve' on the south coast may be particularly interesting as it is one of the very few intact areas of natural lowland forest and the natural form of this habitat has never been studied in detail.

Of this diverse fauna the molluscs are the most thoroughly studied and it has been confirmed that Silhouette has the highest terrestrial mollusc diversity of any island in Seychelles and an exceptionally high level of endemism (19%). This is due to the presence of primary mist forest. Many of these endemic species have very restricted ranges, the most extreme case is that of *Gulella silhouettae* which is restricted to 0.7ha of mossy forest on Mt. Dauban (Verdcourt 1996). The exceptionally high proportion of carnivorous streptaxids in the fauna (see Table 3.) is notable, this is unusual in most faunas but is also found in the high-altitude areas on Mahé. This carnivorous fauna includes the only known representatives of nematode specialist feeders (Gerlach 1996) and radula-less carrion feeders (Gerlach & van Bruggen in prep.). Silhouette also probably supports the highest biomass of land snails in the world; data on the mass of living snails are lacking but individuals densities are exceptionally high and are dominated by the large acavid *Styldodonta unidentata.* The values of $1.11m^{-2}$ for this species is probably its natural level (lower figures from other islands being due to predation by rats, *Rattus* spp. and tenrecs, *Tenrec ecaudatus*) but may also be boosted by the abundance of food (especially jak fruit, *Artocarpus heterophyllus*).

Extensive studies have also been carried out on the arachnid fauna of which 80 spider species have been identified to date (44% of the approximate 180 Seychelles species). Endemism appears to be very high among the Silhouette spiders as 60 are endemic to Seychelles (of the others only 10 are pantropical and 10 African). Of Seychelles endemics 31 species belonging to widely distributed genera

Table 4. Invertebrate density in *Pisonia sechellarum* forest (data from OUSE 1990)

Taxon		Density (per m^2)			
		litter	ground area	on vegetation	Total
Nemertea		0.02	0.01	<0.01	0.01
Annelida	Hirudinea	0.15	0.04	0	0.04
Mollusca	Streptaxidae	1.07	0.26	0.01	0.27
	others	4.57	1.13	0.23	1.46
Arachnida	Araneae	1.30	0.34	0.53	0.87
	Opiliones	0.47	0.11	0.01	0.12
	Acari	33.70	8.32	0.03	8.35
Crustacea	Isopoda	6.12	1.51	0	1.51
Myriapoda	Diplopoda	5.36	1.38	0	1.38
	Chilopoda	1.25	0.31	0	0.31
Insecta	Coleoptera	37.17	9.18	-	-
	Formicidae	32.65	8.06	-	-
	other Hymenoptera	1.07	0.26	-	-
	Dermaptera	12.75	3.15	-	-
	Hemiptera	3.98	0.98	-	-
	Diptera	15.75	3.89	-	-
	Orthoptera	0.08	0.02	-	-
	Isoptera	0.07	0.02	-	-
	Lepidoptera	7.8	1.93	-	-
	Psocoptera	0.03	0.01	-	-
	Dictyoptera	0.02	<0.01	-	-
Total invertebrates		**165.38**	**40.83**	-	-

(3 of these appear to be restricted to Silhouette), 29 belong to endemic genera (13, or 16%, apparently Silhouette endemics). Other important arachnid populations include endemic holothyrid giant mites, opilionids and amblypygids (sight records include a large species which is probably the rare *Phrynichus scaber*).

The myriapod fauna is very significant in terms of diversity, the proportion of Seychelles endemics and its ecological role. The most obvious species is the Seychelles endemic giant millipede *Seychelleptus seychellarum*. This species occurs at a density of $0.11m^{-2}$ and is probably the main detritivore, along with the snail *Stylodonta undientata*. The only other islands retaining large populations of this species are Fregate, Aride, Cousin and Cousine. Thus Silhouette is the only large island to retain the large detritivore communities that have been lost or reduced on islands such as Mahé, Praslin and La Digue (probably through predation, mainly by tenrecs, and habitat destruction). Other rare species persist in significant numbers, such as the pill-millipede *Cyliosomella furciparum*. A recent record is the distinctive white-headed millipede *Benoitiulus flavocollaris* which was found in Jardin Marron in 1996, previously the species was known only from the Le Niol area of Mahé. It is probably widespread at around 300-400m above sea-level, its recent discovery and the new range record are further evidence of the comparative lack of research into the fauna of the mid-altitude areas.

The taxonomy of most insect groups is in need of revision. Of the groups that are well known Silhouette supports significant populations of endemic Orthoptera. This includes several endemic species of cricket. The Phasmidae of

Silhouette are of exceptional importance as this is the only island to support all 6 Seychelles species, including one Silhouette endemic (the stick insect *Carausius scotti* which is associated with the birds nest fern *Asplenium nidus*).

The Silhouette amphibian and reptile faunas are of exceptional significance with most native species having been recorded. The unrecorded species are either specialists of sea-bird islands (*Mabuya wrightii*) or recently recognised species which have not been searched for to date (*Ailuronyx tachyscopaeus* and *A.* cf. *trachygaster*). The blind snake *Rhamphotyphlops braminus* is probably present in agricultural areas but has not been located. All the Seychelles amphibians are present although distribution records for the caecilians are very poor.

Historically large reptiles were abundant with crocodiles (*Crocodylus porosus*) and hawksbill turtles (*Eretmochelys imbricata*) being reported around the coast in 1771 (Gerlach 1995a). Both tortoises and terrapins were present although neither was identified to species. On biogeographical and evolutionary grounds it is probable that the early records of abundant giant tortoises refer to both species known to have occurred in the central granitic islands (*Dipsochelys hololissa* and *D. arnoldi*). It is also probable that two species of terrapin were present; *Pelusios castanoides* and *P. subniger,* the former may have been represented by the supposed endemic 'species' *P. seychellensis.* Both tortoises and terrapins were exterminated by hunting, the former having been recorded in 1771-1787 and the latter only in 1927 (Bour 1984).

Birds are represented by relatively few species, the majority are native and significant populations of Seychelles kestrel (*Falco araea*) and Seychelles blue pigeon (*Alectroenas pulcherrima*) are present. A notable breeding species is the white-tailed tropic bird (*Phaethon lepturus*) which nests in the high-altitude forests. As the breeding birds bring fish to their nests this species is a significant importer of nutrients into the Silhouette forest ecosystem and contributes to the high biomass and diversity of the detritivore community. The introduced species are largely restricted to lowland areas, although Indian mynahs (*Acridotheres tristis*) do venture to the high forest they are not resident there. The only introduced species to spend significant periods of time in the mid-high altitudes are the barn owls (*Tyto alba*). It is estimated that fewer than 12 pairs are present. Introduced house crows (*Corvus splendens*) were seen in 1979 (Greig-Smith 1979) but did not establish themselves on the island and now appear to be extinct in Seychelles. Lowland marshes are inhabited by moorhens (*Gallinula chloropus*) which are increasing in numbers. Two grey herons (*Ardea cinerea*) have been present since 1995, one of these was still immature in January 1997 and breeding has not occurred. Cattle egrets (*Bubuculus ibis*) occasionally visit the island but have never established themselves. Juvenile black-crowned night-herons (*Nycticorax nycticorax*) have also been recorded but at present the only breeding heron is the green-backed heron (*Butortoides striatus*) which is common around the coast. It is probable that several of the currently rare species occurred on Silhouette in the past. It is known that green parakeets (*Psittacula eupatria*) were present until the 1890s. These are now extinct although an unidentified parakeet (believed to be *P. krameri*) has been seen on Silhouette since 1995. If a population of a parakeet species were to become established this

could restore an important pollinator and seed dispersal agent. A species of *Zosterops* white-eye was reported to be present until the lowland forests were cleared in the 1920s (H. Dauban *pers. comm.*), white-eyes may have been heard in 1979 (P. Greig-Smith *pers. comm.*) although subsequent searches have failed to verify these records. It is highly probable that white-eyes were present. Anecdotal records have also been received concerning the presence of scops owls (*Otus insularis*). These have also not been verified. It is also believed probable that species such as the Seychelles black paradise flycatcher (*Terpsiphone corvina*), black parrot (*Coracopsis nigra*), Seychelles warbler (*Acrocephalus sechellensis*) and Seychelles magpie robin (*Copsychus seychellarum*) were present in the past. No ornithologist visited the island until 1866 (Newton 1867) and the first thorough ornithological investigation was made in 1979 (Greig Smith 1979).

Both native mammal species are present. The only known active roost for the sheath-tailed bat (*Coleura seychellensis*) is at La Passe. This has contained up to 25 bats (Matyot 1996). Others are probably present but only old abandoned roosts are known. Silhouette has a large population of fruit bats (*Pteropus sechellensis*) which are present throughout the island and are active at all times of day and night. This unusual behaviour pattern is also found on La Digue and is probably the consequence of the virtual absence of hunting on these islands. The presence of the bats in all habitats may contribute to the integrity of the island's forests with the bats fulfilling their natural fruit disperser role. On Mahé, in contrast othe bats feed almost exclusively in suburban areas, as a consequence large seeded trees such as *Northea hornei* are not dispersed and their age composition on Mahé is skewed towards old trees whilst Silhouette retains a more even spread with abundant seedlings.

CONSERVATION

Introduced plants

Silhouette has retained a more natural fauna and flora than any of the other large islands of the Seychelles group, due primarily to its steep, rocky slopes which have restricted agriculture and development. Tree plantations were established in lowland and mid-altitude areas between 1860-1950. These resulted in the replacement of some 110ha of natural forest with plantations of *Hevea brasiliensis, Coffea canephora, Tabebuia pallida* and *Cocos nucifera*. In addition cultivated trees have spread into the forests from agricultural areas. The most important of these are *Psidium cattleianum, Cinnamomum verum* and *Artocarpus heterophyllus*. Several other species have also been recorded in natural forest. Despite widespread invasion most of Silhouette's forest retain a high diversity of native plants and animals. With very limited disturbance and the survival of most native tree dispersal agents, indigenous species have been able to regenerate in abandoned plantations and invaded areas. Comparison of the diversity of dominant tree species in forest areas cleared at different times over the last 80 years demonstrates a healthy forest regeneration and a return towards semi-natural forests (Fig. 2.)

Above Grande Barbe forest regeneration is more restricted than on the eastern side of the island. This is largely a consequence of three major fires in this

area; in 1914, the late 1950s and 1966. These have damaged the seed-bank in this area and delayed regeneration. This is now occurring from seeds of the palms *Deckenia nobilis, Phoenicophorim borsigianum* and *Nephrosperma vanhouetteana* and the tree *Dillenia ferruginea,* with numerous shrubs of dry glacis and fire damaged habitats. A similar process of regeneration is apparent in areas dominated by the invasive shrub *Clidemia hirta* (Gerlach 1996). This species is spreading rapidly and has recently extended its range into the relatively dry south of the island during a period of increased rainfall. Natural forest regeneration in areas dominated by this species since the late 1990 demonstrate that invasion by this species is likely to be a temporary, although dramatic, phenomenon as long as the surrounding forests and seed-banks remain healthy.

Introduced mammals

Introduced mammals have included Javan rusa deer *Cervus timorensis* which were introduced in the 1800s. These died out or were hunted to extinction, their presence on Silhouette now only recorded by the horns mounted on the walls of the Grande Case at La Passe. Black rats (*Rattus rattus*) are present in all habitats. Trap data indicate that the population density is high (capture rate of 30 per 100 trap-nights, compared to 11.5-22 in data in Clout 1980) and significant ecological effects of the presence of this species would be expected. Dietary studies on Silhouette do not provide any evidence of such effects with the rats being almost entirely frugivorous, feeding on coastal *Terminalia cattapa* and *Clidemia hirta, Begonia sechellarum* and *Artocarpus heterophyllus* at high altitudes (Table 5.). The proportion of the latter species is under-estimated in faecal analysis due to its complete digestion. This is shown by examination of stomach contents, all stomachs examined contained pulp of this species in addition to seeds of *C. hirta* and *B. sechellarum* and ants

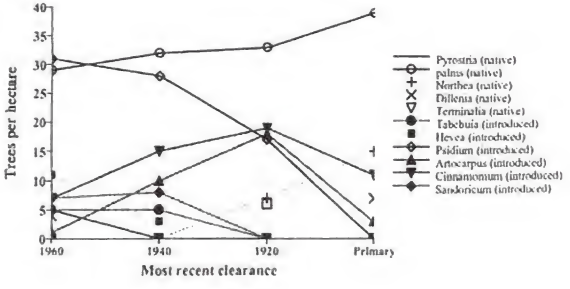

Fig. 2. Changes in forest composition following clearance. Trees over 2m high were counted in 1ha quadrats, only species making up >5% are shown.

Table 5. Analysis of rat faeces (8-9/96) - number of items (present in % of samples).

Altitude		10m	400m	550m
Number		20	25	50
Plant	Shoot	7 (35%)	-	-
	Fruit	18 (90%) *Terminaila*	-	-
	Seeds	5 (25%) *Terminaila*	5 (4%) *Begonia* 572 (100%) *Clidemia*	23 (4%) *Begonia* 342 (100%) *Clidemia*
Animal		1 (5%) snail (*Melanoides*)	-	-

(*Pheidole* sp.). There is no adverse effect of this frugivory on the native plant species as germination rates are not affected in *B. sechellarum*. The only animal remains recorded appear to have been accidentally ingested. No food caches were found on Silhouette although these are frequently encountered on other islands where they comprise seeds and snail shells. 85% of dead shells of *Stylodonta unidentata* found on Mahé are rat damaged whereas only two rat damaged shells have been found on Silhouette, both on the edge of settlement areas. Rat predated seedlings and growing shoots were not located on Silhouette despite the abundance of forest tree seedlings whereas recently dead seedlings are common on Mahé. These differences are probably due to the abundance of *A. heterophyllus* which provide year-round fruit with a high protein content, satisfying their breeding dietary requirements without the need for animal protein.

Cats (*Felis cattus*) are present on Silhouette. These have been observed in several localities and have been recorded hunting rats in the forests at night. They are only common around the settlement areas. There does not appears to be a feral cat population on Silhouette at present although the presence of domestic cats makes this highly probable in the future. The diet of the cats is almost entirely restricted to rats (93% of 30 scats examined from different sites) although some opportunistic consumption of invertebrates (grasshopper remains in 50% of scats) and carrion is apparent (juvenile fruit bat bones in 1 scat). Dogs (*Canis familiaris*) are also present but are fully domestic and rarely leave the settlements.

Development and conservation prospects

Development potential on the island is very limited. Development attempts have concentrated on the only practical areas; the coastal plateaux as these are the only areas of flat land. Limited fresh-water resources restrict the potential for agriculture or other developments in these areas. The only practical developments of any significant scale would be expansion of tourism. Given the restricted areas of suitable beaches and the difficulty of access only a limited expansion of the eco-tourism marked would be practical.

Conservation of the island has been entirely informal with the exception of the declaration of the Silhouette Marine National Park in 1987. Conservation measures and proposals have included the practice of considering the southern lowland forest as a reserve since the 1800s (Gardiner 1910) and the proposal for the protection of the mist forest, lowland forest and lowland glacis areas (Swabey 1970). Under the management of the Dauban family for 100 years from the middle of the last century, especially under Henri Dauban, management practices on the

island have included some degree of environmental sensitivity despite the expansion of the plantations. Under the more recent management by the Islands Development Company the forests have been treated as effective reserves with virtually no interventionist management. This has allowed the forests to remain largely intact and has contributed to the healthy regeneration that is apparent.

In 1994 The Nature Protection Trust of Seychelles was invited by the IDC to advise on forest conservation in order to ensure their preservation. The NPTS has prepared a managment plan to restore the island to as near a natural state as possible ('natural' being approaching the original state described in Gerlach 1995a). This will be implemented in conjunction with IDC. In 1997 the NPTS was able to establish a permanent presence on the island and is currently developing its information centre as a first step towards the establishment of a research station on the island. This initiative has received much interest and support form international organisations and international funding projects are being developed to ensure the preservation of one of the most important biodiversity hotspots in the western Indian Ocean.

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On *Polposipus herculeanus* Solier, 1848 (Tenebrionidae: Coleoptera) on Round Island, Mauritius

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Key words: biogeography, Fregate, Seychelles

Abstract: Historical records of the distribution of the Fregate island giant tenebrionid beetle *Polposipus herculeanus* were examined. It was concluded that a specimen reputedly collected on Round island, Mauritius in 1869 is correctly labelled. This species is one of several invertebrates recorded from Seychelles and from Round Island, Mauritius. Such species proably had a general western Indian Ocean distribution before the region was colonised.

Introduction

The highly distinctive tenebrionid beetle *Polposipus herculeanus* (Solier, 1848) is currently restricted to the island of Fregate in the central granitic group of the Seychelles islands. There are only two records from other localities, both of which have at times been viewed as being erroneous. The purpose of this paper is to review these records in order to determine the likely natural distribution of the species.

The Bengal specimen

The holotype is a specimen from the Dupont collection, with the type locality of Bengal. The specimen is labelled as having been collected by Duvacel. These data were refuted by Gebien (1922) and this has been accepted in all subsequent references. In the absence of any further information on the date of collection the origin of this specimen cannot be determined.

The Round Island specimen

In 1870 a specimen was entered into the British Museum (Natural History) Entomology Department accessions register as 'Platynotus sp. nov.'. This specimen was subsequently described as *Dysceladus tuberculatus* by Waterhouse (1875) which was subsequently synonymised with *P. herculeanus* by Gebien (1922). It is part of the material collected by Lt-Col. N. Pike on Round Island, Mauritius in 1869. The validity of the collection data have been disputed since 1962 (Vinson 1962 - although subsequently listed as a Mauritian-Seychelles species in Vinson 1967; Lionnet 1971) due to the inability of all subsequent expeditions to locate the species on Round Island and to the strange biogeographical pattern that acceptance of this record would imply. These references did not consider the impact of habitat degradation upon the beetle's habitat.

If the specimen was not collected on Round Island it must presumably have been a mis-labelled Fregate island specimen. Accordingly it has been suggested that either it was collected in Seychelles by Pike on his visit there or that it was sent to him by Ward who was resident in Seychelles at the time and who corresponded with Pike (Lionnet 1971). The former suggestion can be discounted as Pike did not visit Seychelles until 1871, a year after the specimen was entered in the BM(NH) records. The alternative suggestion could be acceptable if taken at face value but although Ward did send Pike written information on Seychelles (Pike 1873) there is no evidence of Ward sending out any specimens other than birds (Newton 1867). It has been suggested that the locality should be one of the Seychelles Round Islands (Champion 1914; Scott 1932) although there are no records of any naturalists or collectors visiting these islands at this time. This suggestion is not supported by any evidence and is an un-necessary complication.

If the available information relating to Pike's visits to Round Island are examined some light can be shed on this problem. Pike made two visits to the island: 6-8th Dec. 1868 and 9-10th Nov. 1869. On the former he noted the presence of "coleopterous insects, I think, of the genus *Tetramerans*" and collected some specimens (as indicated by a record of scorpions changing colour on placing in alcohol) (Pike 1870a & 1873). He does not give a specific description of his second visit (a description is given in Barklay 1870) but most of the material he collected appears to derive from the second visit. The collection he made was exhibited at the Mauritian Royal Society before being sent to England by Barklay. It contained several beetle species, of which number 27 was described as "A very singular beetle, of which I can find neither figure nor description, and I have never seen it in Mauritius" (Pike 1870), this is described elsewhere as "one brown beetle, about 11/2 inch in length, tubercled all over - but I can find neither figure nor description of it, nor do I think it is in Mauritius." (Pike 1873) and is identifiable as the *P. herculeanus* specimen. It is apparent that Pike himself was clear that it was one of his Round Island specimens and that it was in his possession before the 30th December 1869 when the collection was exhibited at the Mauritius Royal Society (Barklay 1870).

Of the rest of Pike's material only two beetles were entered into the BM(NH) register alongside the *P. herculeanus* specimen. These two, 'Uloma sp.' and 'Cetonia maculata', are identifiable as *Alphitiobius diaperinus* (Panzer) and *Protaetia aurichalcea* (Fabricius, 1775), both widely distributed in the Indian Ocean (Marshall 1982). It is interesting to note that the accession register for 1870, which contains details of the case delivered by Sir Henry Barkly appears to be incomplete in other respects. A scolopendrid centipede was reported by Barkly (1870) in the case and is not mentioned in the accession record, however examination of the centipede collection at the BM(NH) reveals a scolopendrid dated 1870, suggesting that the specimen was delivered but not entered in the register. Other beetle material in the BM(NH) labelled 'Round Island, Mauritius' comprises 8 specimens identifiable as Curculionidae (*Cratopus griseovestitus* Linell, 1897, *C. aurostriatus* Fairm., 1892 and *C. segregatus* Champion, 1914) and Oedemeridae (*Oxacis grisescens* (Fairm., 1897)). These are all western Indian Ocean species,

three of which are restricted to Seychelles and Round Island, and one which is also found in Madagascar and Glorieuse. This total of 11 specimens of 7 species with Round Island, 1870 data matches the 'half dozen' species and the number of specimens referred to by Pike (1870) as being in the collection from Round Island.

There are additional Seychelles species that have specimens from 'Round Island' (eg. Oedmeridae: *Ananca aldabrana* Champion, 1917 and Mordellidae: *Mordella peregrinator* Champion, 1917) but the data on these are ambiguous and are not explicitly the Mauritian Round Island.

Pike's Round Island beetles thus contain two widespread species and five restricted to the western Indian Ocean. Although *P. herculeanus* is the only species with such an extremely disjunct distribution, three species approach the pattern closely. This suggests that it is plausible that all the specimens have the same origin, in which case Round Island, Mauritius is most likely.

The remainder of the material has all been accepted as true Round Island material with the exception of one snake. Vinson (1964) claimed that the material included a dried specimen of a snake "charactéristique des Seychelles". This specimen appears to be the same as the one described by Pike (1870b) as "The died (sic) specimen I sent you however was very pugnacious and bold raising and flattening his head like the poisonous Snakes ... Unlike any other Snake I know, it glides with extreme rapidity over the ground with its head elevated." The detail provided implies that Pike had seen the specimen alive and had collected it himself, in which case it must have been collected on one of his Round Island visits. All the snakes collected by Pike and donated to the BM(NH) by Barklay are identified and registered as *Casarea dussumieri* or *Boyleria mulicarinata*, both Round Island endemics. Vinson's claim that a Seychelles species was included presumably rests on a mis-identification and cannot be used to dispute the provenance of the material. This raises a dilemma since Vinson was a good herpetologist well aquainted with the round Island species. Perhaps the poor condition of this dried specimen caused Vinson to make an uncharacteristic error. Unfortunately this specimen cannot be located and the true identity cannot be determined.

The biogeographical connection between Round Island and Seychelles is also apparent in other invertebrates, notably the scorpions and amblypygids. Of the former, three Round Island species include a cosmopolitan species (*Isometrus maculatus* Geer), an endemic species *Lychas serratus* (Pocock, 1890), a genus otherwise restricted to Africa and Seychelles, and a western Indian Ocean species *Ischnurus ochropus* Koch, 1838 found also in Seychelles and on Zanzibar, this distribution is also found in the amblypygid *Phrynichus scaber* Gervais.

The arthropod fauna of Round Island thus appears to have a strong biogeographical connection with the islands of the Seychelles group and to have relatively little connection with Mauritius. This association could be explained by two hypotheses. Firstly that the distribution represents a pattern caused by dispersal through rafting. Colonisation of Round Island must inevitably have been by rafting for the flightless taxa and although rafting from Mauritius would seem most likely, long distance transport from Seychelles is a possibility (Fig. 1.). The alternative is that the Seychelles - Round Island distribution is a remnant of a more general

western Indian Ocean distribution. Under this hypothesis several other populations of these species would have been exterminated through habitat destruction and predator introduction since the colonisation of Seychelles and the Mascarenes in the 18th and 17th centuries respectively. A combination of these two possibilities may be the most accurate explanation. Species which have survived habitat disturbance and predator introduction can only be explained by the vagaries of oceanic dispersal. This applies to the *Cratopus* weevils of which Pike collected three non-Mauritian species on Round island. These are not known to survive on the island at present and have been replaced by the Mauritian *C. punctum* Champion, 1914 (Vinson 1949). Most of the flightless species have highly disjunct distributions within Seychelles and are rare on heavily disturbed or predator colonised islands. These species may have had a wider distribution in the past and may have been present on both Round Island and Mauritius. Of these only the amblypygid *Phrynictus scaber* survives on Round Island. The most extreme case is the giant tenebrionid *Polposipus herculeanus*, now restricted to Fregate island.

There are a further 6 specimens in the BM(NH) labelled "Seychelles". These are from the Nevinson collection and were purchased from O.E. Janson who bought them from an amateur collector. Their island of origin is not known. All subsequent specimens are known to have been collected on Fregate (Including J.S. Gardiner's 14 specimens from 1905 and 1908). One other puzzle remains; that is the failure of Pike to collect *P. herculeanus* on Fregate when he visited the island in 1871. His description of the island as treeless with only bushes (Pike 1872) implies that the present-day abundance of the beetle may be a result of the maturation of plantations on the island providing abundant dead wood for the larvae.

In conclusion it is probable that the historical arthropod fauna of Round Island was dominated by western Indian Ocean species, some of which were also present on Mauritius but were exterminated early in the human history of the island. This fauna was collected by Pike in 1868 and 1869 and included the giant tenebrionid beetle *Polposipus herculeanus*. This species is therefore known to have occurred on Round Island, Mauritius and on Fregate island, Seychelles. It is probable that it was also present on other islands in the Seychelles group.

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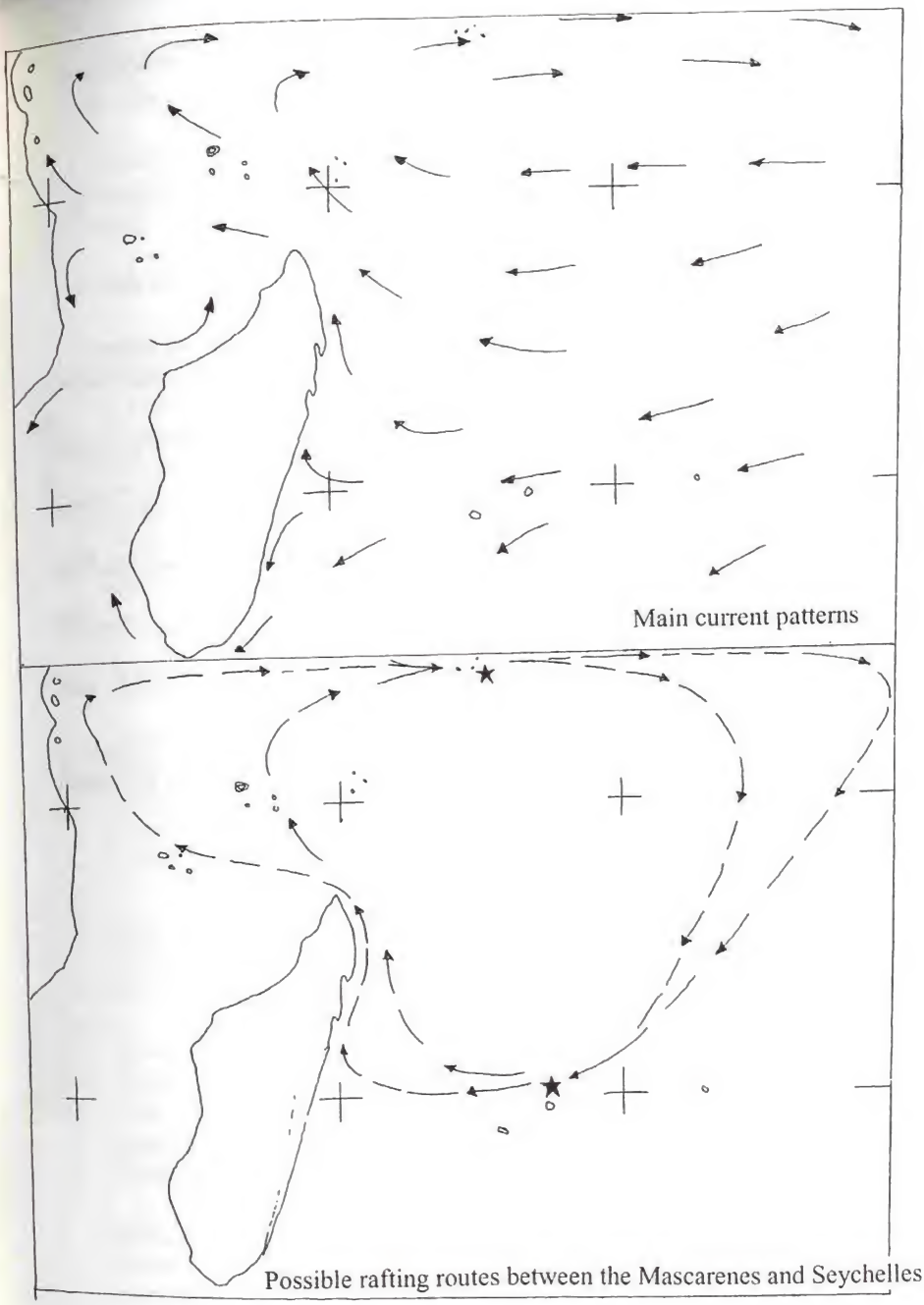

Fig. 1. Ocean currents of the Indian Ocean

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Scytotids (Arachnida, Araneae, Scytodidae) of the granitic islands of Seychelles

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Key words: *Dictis, Scytodes, Soeuria*

Abstract: Six scytotid spiders are recorded from the granitic Seychelles islands. Of the previously published species *Scytodes velutina* Heineken & Lowe, 1835 is stated to be misidentifications of *Scytodes fusca* Walckenaer, 1837 or *Scytodes amaranthea* Vinson, 1863 and *Scytodes perimensis* Simon, 1890 those of *Scytodes berthelotii* Lucas, 1839 or *S. fusca*. The genus *Dictis* L. Koch, 1872 is revalidated and an undetermined, but apparently close relative of its type species, *Dictis striatipes* L. Koch, 1872, is presented. Finally, one new genus *Soeuria* n. gen. with one new species *Soueria soeur* n. sp., is described.

Introduction

Scytotids or spitting spiders have a large, domed carapace with six eyes in three diads and usually a globular abdomen about the size of the cephalothorax. Legs are thin and fairly long but smaller species usually have relatively shorter legs which is probably connected with their habit of living amongst litter. One Seychelles species, *Scytodes pholcoides* Simon, 1898, has an exceptionally long, cylidrical abdomen and also extremly long legs and thus closely resembs pholcids.

Scytotid females have no epigyne. Instead there are a pair of copulatory pockets (scutula of Brignoli 1976) posterior to the epigastric sulcus. In essence they are more or less depressed, well chitinized areas, with a shallow pocket-like cavity at their mesial edge. There are numerous variations from this basic form.

The family Scytotidae Blackwall, 1864 is another example of conservative taxonomic thinking, reflected by the fact that, at present, all ca.140 species are placed in a single genus. In fact, only one other genus, *Dictis* L. Koch, 1872, has ever been described in the family. Even Brignoli (1976) who dealt with the genus in depth did not mention the possibility of using more genera. However, from his drawings of secondary genital organs it is apparent that several genera are involved.

It is also clear that none of the species found in Seychelles are congeneric with the type species of *Scytodes*, viz. *Aranea thoracica* Latreille, 1802. Therefore, in three cases the generic name has been used in quotation marks to highlight the author's view that the species in question is not a member of the genus *Scytodes*. On the other hand, the genus *Dictis* L. Koch, 1872 is revalidated with a species close to its type species (*Dictis striatipes* L. Koch, 1872) recorded from Coetivy. Furthermore, a new genus with one new species is described.

In literature only a few old records of Seychelles scytotids can be found (Simon 1893 and 1898, Hirst 1911). With the exception of the endemic *S. pholcoides* all have proved to be misidentifications.

The material treated below belong to the following collections:

BMNH = British Museum (Natural History), London
MNHN = Muséum National d'Histoire Naturelle, Paris
MRAC = Musée Royal de l'Afrique Centrale, Tervuren
MZT = Zoological Museum of Turku University, Turku
ZMH = Zoologisches Museum der Universität Hamburg, Hamburg

All measurements cited below are in millimetres. For describing the relative height of the carapace a carapace index (CI = maximum height of carapace/ maximum length) and a leg index (LI = length of carapace/ legth of the first tibia) for the relative length of the leg have been used in the text.

"Scytodes" amaranthea Vinson, 1863

Scytodes amaranthea Vinson, 1863: 297, Pl. 1., f. 2 (female, Réunion)
Scytodes velutina, Simon 1898: 671 (female, misidentification).

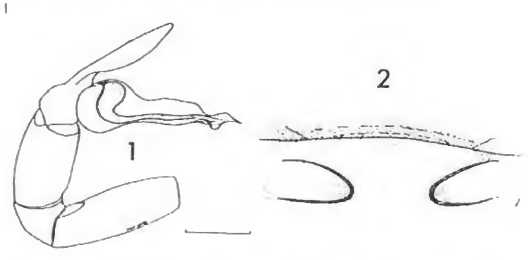
Diagnosis: It may be distinguished from other local scytotids by its small size (male ca.2.5, female 3.4) combined with short legs (CI: male=1.13, female=1.35).

Description: No relevant material was available for a detailed description.

Reference material: "Scytodes" velutina Heineken & Lowe, in Lowe, 1836 males and females from Corsica (Figs. 1-2).

Distribution: This is an Afro-tropical species (Lehtinen, *pers. comm.*) which has been recorded once from Seychelles; **Mahé:** Simon (1898, as *Scytodes velutina*).

Discussion: I have not seen Simon's (1898) material but it seems logical to assume that the species found in Seychelles is the one originally described from Madagascar rather than that living mainly in the Mediterranean area.



Figs. 1-2. *"Scytodes" velutina* Heineken & Lowe 1836 from Corsica. Original figure. Scale bar 0.2 mm. 1). Right male palp ectally. 2). Epigyneal area ventrally.

"Scytodes" berthelotii Lucas, 1838 (Figs. 3-7)

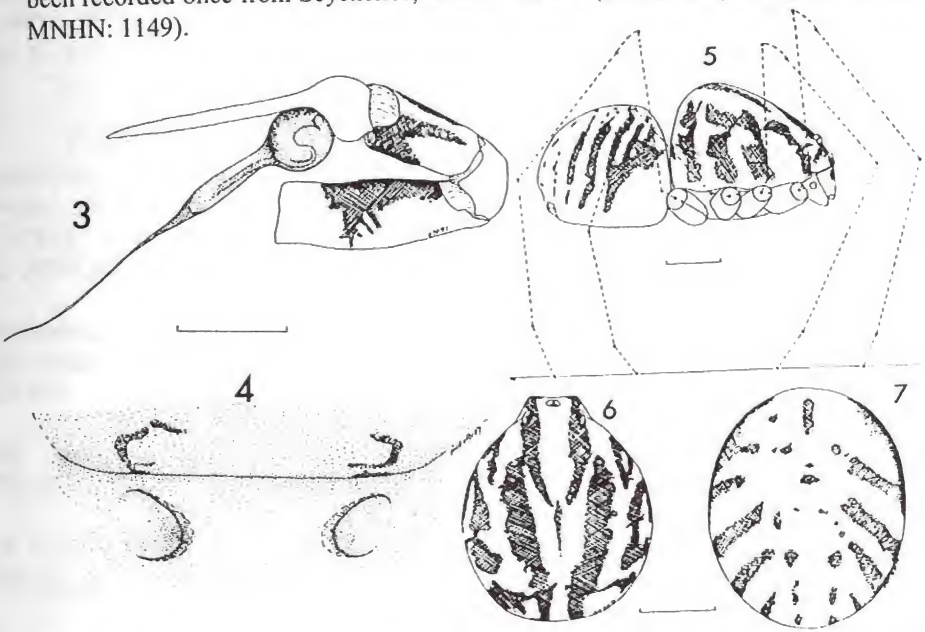
Scytodes berthelotii Lucas, 1838: 25, Pl. 9, f. 6 (female: Canary Islands).

Scytodes perimensis, Simon 1898: 371 (juv., misidentification).

Diagnosis: The males of *"S." bethelotii* may be distinguished from the other scytotids by the small spherical bulbus and the very long embolic part, of which two thirds is very thin and thread-like. The females may be distinguished by the somewhat triangular copulatory pockets which are about twice their height apart.

Description: Fairly large and massive species; total length 6.4-7.0. Length of carapace 3.14-3.21. Male carapace much lower than that of female; CI of male = 0.23 and that of female = 0.53. The first two leg pairs of the male somewhat shorter but more slender than those of the female; LI of female = 0.48, that of male = 0.55. Male palpal tibia unswollen. Bulbus small, spherical. Embolic part very long; its basal part (ca. one third of its total length), thick and tapering quite abruptly into a long, thin, almost thread-like distal part. Copulatory pockets of the female well developed, more or less triangular, about twice their height apart.

Distribution: This is a Mediterranean-African (Brignoli 1976) species which has been recorded once from Seychelles; **Mahé:** Simon (1898, as *Scytodes perimensis*, MNHN: 1149).



Figs. 3-7. *"Scytodes" berthelotii* Lucas, 1838. Original figure. Scale bars: Fig. 3-4. = 0.5mm; Fig. 5-7. = 1.0mm. 3). Left male palp ectally. 4). Epigyneal area ventrally. 5). Female dextro-laterally. 6). Carapace dorsally. 7). Abdomen dorsally.

"Scytodes" fusca Walckenaer, 1837 (Figs. 8-12)

Scytodes fusca Walckenaer, 1837: 272 (female, French Guiana)
Scytodes (Dictis) perimensis, Simon 1893: 205 (male, misidentification)
Scytodes velutina, Simon 1898: 371 (misidentification)
" Hirst 1911: 381 (female from Mahé, misidentification).

Diagnosis: The males of *"S". fusca* may be distinguished from other scytotids by the long, narrow embolic part with downwards pointing setaceous tip and by the swollen palpal tarsus. The females have relatively small, unsclerotized sperm pockets connected to the atrium via narrow and fairly strongly sclerotized ducts.

Description: Medium sized species; total length 4.4-5.0. Length of carapace 2.21-2.43. Male carapace much lower than that of female; CI of male = 0.44 and that of female = 0.61. The first two leg pairs of the male much longer than those of the female; LI of female = 0.82, LI of male = 0.53. Male also much lighter coloured than female; cephalothorax and legs pale yellow with dark violet markings, abdomen whitish with dark violet transverse stripes. Female carapace more or less uniformly dark chestnut brown, abdomen dirty white with same kind of dark transverse stripes as the male. Palpal tibia of male clearly swollen. Bulbus somewhat pyriform. Its embolic part long and slender with downwards pointing setaceous tip. Copulatory pockets of the female well developed, more or less triangular, about 1.5 times their height apart.

Distribution: This cosmotropical species is well established in Seychelles:

Mahé: Hirst (1911, as *Scytodes velutina*; BMNH) and Centre, Bon Espoir (300m), 1subad-male, 1 female, 1j., 21.VI.1972, and Sud, Baie Lazare, 1subad-female, 26.VI.1972, P.L.G. Benoit & J.J. Van Mol leg. (MRAC 143.233 & 143.330) and Roche Caiman Bird Sactuary, leaf litter, 23.XII.1993, 1j., Justin Gerlach leg. (MZT AA 0.301).

Praslin: Fond Ferdinand, 1 female, 24.VII.1972, Fond de l'Anse, 3subad-males, 2 females, 9j., 16.-24.VIII.1972, and Grand Anse, 3subad-females, 16.-24.VIII.1972, P.L.G. Benoit & J.J. Van Mol leg. (MRAC 144.724, 143.393 & 143.350).

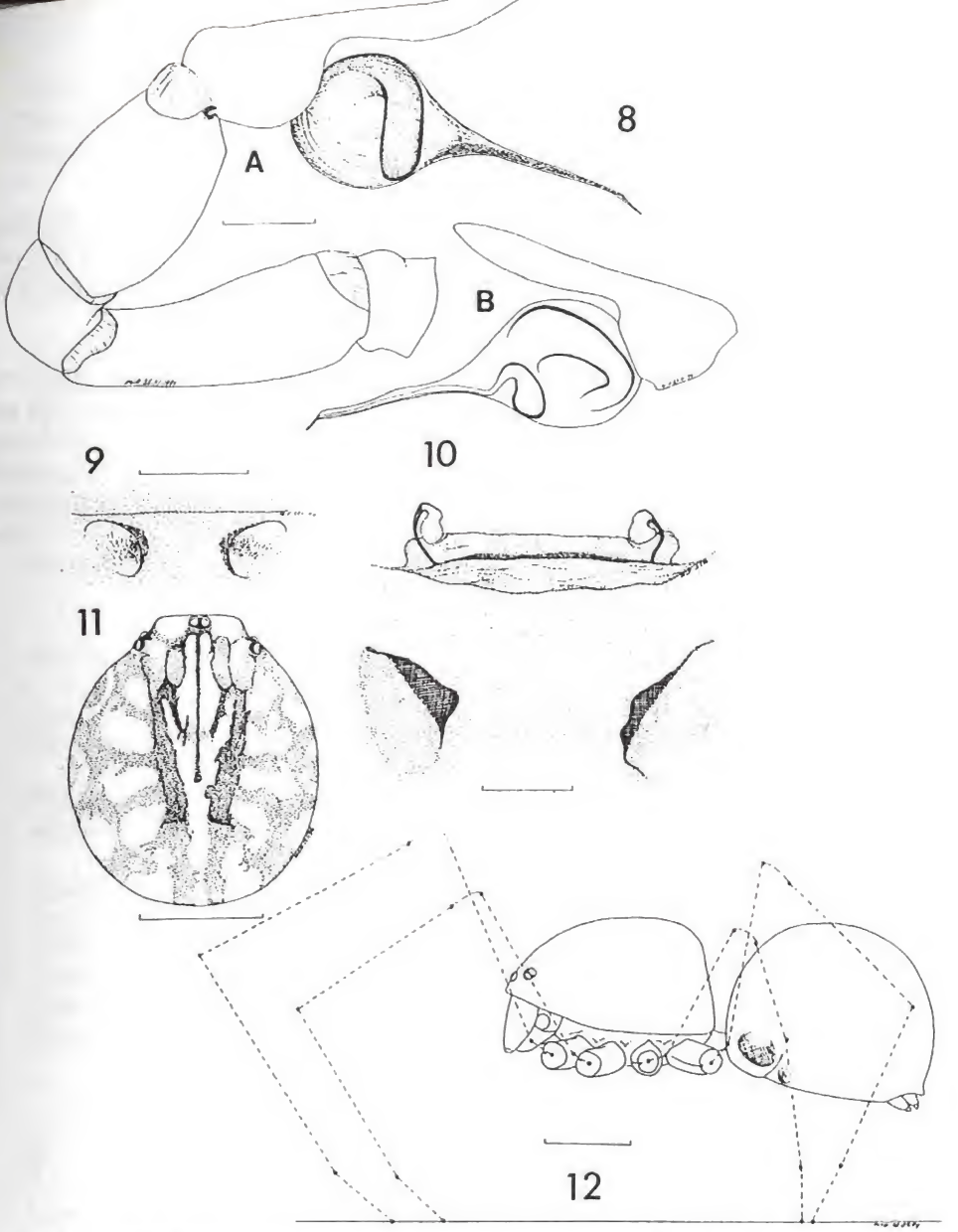
Curieuse: Centre, Foret dégadée, 1j., 17.VIII.1972, and Baie Laraie, dans mangrove, 2subad-males, 2j., 3.VIII.1972, P.L.G. Benoit & J.J. Van Mol leg. (MRAC 143.167 & 143.279)

Aride: 1 female, 9. VIII.1975 and 1j., 11.VIII.1975, M. Mühlenberg leg. (MZT AA 0.324 & 0.325) and 2 males, 1subad-male, 3 females, 1996, Justin Gerlach leg. (MZT AA 0.365)

Cousin: 2 females, 1978, Hugh Watkins leg. (MZT AA 0.056 & 0.326)

La Digue: Simon (1893)

Discussion: I have not seen Simon's (1893) material but his description unambiguously refers to the male of *"S". fusca.*



Figs. 8-12. *"Scytodes" fusca* Walckenaer, 1837. Original figure. Scale bar for Fig. 8. & 10. = 0.2; Fig. 9. = 0.5; Fig. 11. & 12. = 1.0 mm. 8). Right male palp ectally (A) and mesially. (B). 9). Epigyneal area ventrally. 10). Vulva and copulatory pockets dorsally. 11). Male carapace dorsally. 12). Sinistrolateral view of female.

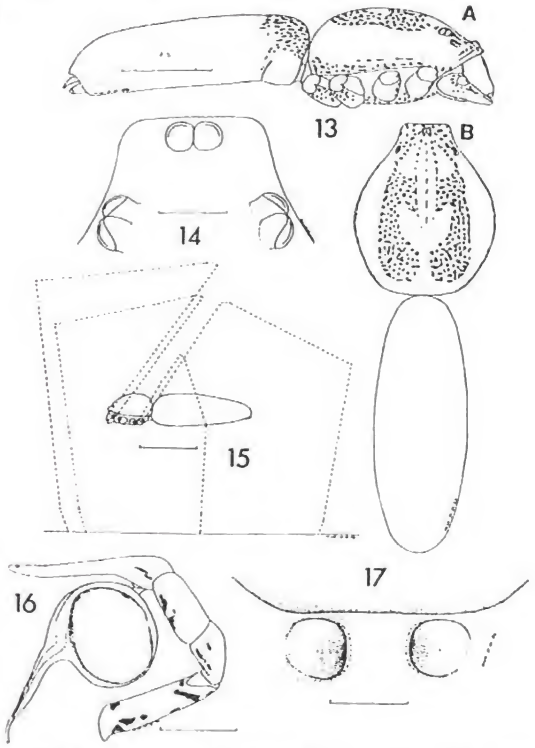
"Scytodes" pholcoides Simon, 1898 (Figs. 13-17)

Scytodes pholcoides Simon, 1898 (male, female)

" Hirst 1911: 381.

Diagnosis: This species may be distinguished from other scytotids by the long, cylidrical abdomen and very long and thin legs. Young specimens are also recognisable for their extremely long legs, although their abdomen is somewhat more compressed.

Description: Large species; total length 8-10. Carapace conspicuosly broad and relatively shallow, CI (female) = 0.49. Abdomen long, cylidrical. Legs thin and very long; LI (female) = 0.28. Basic colour white - yellowish white with very dense dark purplish, almost black markings. Legs densely speckled with dark purplish spots. Bulbus of male palp large, almost spherical with fairly short and stout embolic part. Copulatory pockets of the female well developed, about 1.5 times their height apart.



Figs. 13-17. *"Scytodes" pholcoides* Simon, 1898. Original figure. Scale bar for Fig. 13. = 1.0; Fig. 14. = 0.3; Fig. 15. = 4.0; Fig. 16. & 17. 0.5 mm. 13). Cepalothorax and abdomen of female dextrolaterally (A) and dorsally (B). 14). Eyes of female dorsally. 15). Female sinistrolaterally. 16). Left male palp laterally. 17). Epigyneal area ventrally.

Distribution: Only a few specimen have been collected of this endemic species:
Mahé: Simon (1898), Hirst (1911)
Silhouette: *Pisonia* forest, 1 female, 7j., 1990, Justin Gerlach leg. (MZT AA 0.057 & 0.323).

Discussion: The original syntype series comprize one male, one female and juveniles. All these specimens are in ZMH except one juvenile in MNHN. The ZMH male is herein designated as a lectotype of *Scytodes pholcoides* Simon, 1898.

Genus *Soeuria*, new genus
Type species: Soeuria soeur n. sp.

Diagnosis: At present *Soueria* contains only its type species *Soeuria soeur* and is diagnosed by the same characters as that species.

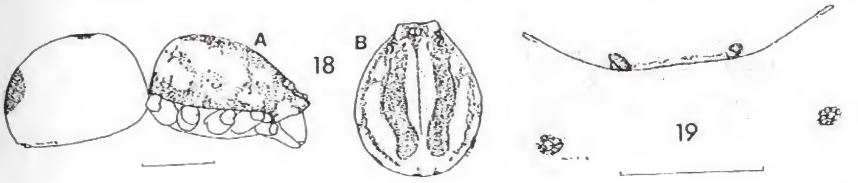
Etymology: The generic name *Soeuria* refers to the origin of the type species.

***Soeuria soeur*, new species** (Figs. 18-19)

Type: Female holotype from Seychelles, Petit Soeur, 24.IX.1975, M. Mühlenberg leg. Deposited in Musée Royal de l'Afrique Centrale, Tervuren (MRAC 177.156).

Diagnosis: The female (male unknown) of *D. soeur* may be distinguished by the reduced copulatory pockets represented by small, squamous areas.

Description: Fairly small species; total length 3.6. Carapace 1.79 long, relatively low, CI = 0.48. Legs rather short; LI = 1.00. Carapace yellow brown with distinct dark brown pattern. Abdomen dirty white with two dorsal dark violet, almost black markings. Distinct dark violet annuli at tip of the femora, base of metatarsi and at both ends of tibiae; patella totally dark coloured. These markings are especially distinct on the last pair. Copulatory pockets reduced to small, squamous areas.



Figs. 18-19. *Soeuria soeur*, new species. Original figure. Scale bar for Fig. 18 = 1.0; Fig. 19 = 0.5 mm. 18). Cepalothorax and abdomen of female dextrolaterally (A) and carapace dorsally (B). 19). Epigyneal area ventrally.

Distribution: Known only from Petit Soeur, Seychelles.

Etymology: The specific epithet is derived from the generic name of the species.

Genus *Dictis* L. Koch, 1872

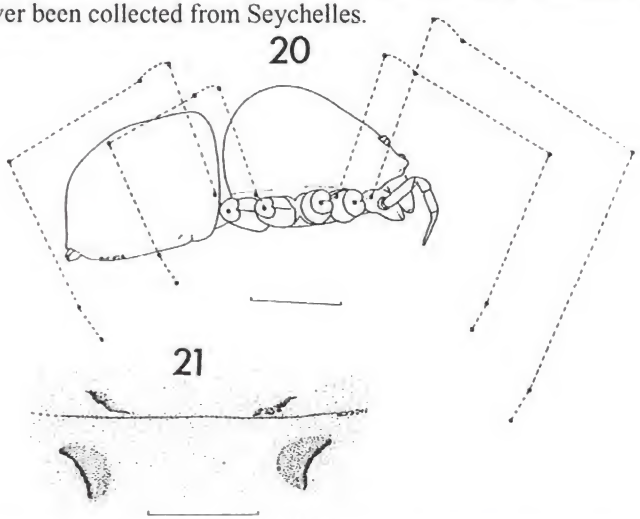
Dictis L. Koch, 1872: 294 - Type species *Dictis striatipes* L. Koch, 1872 from Polynesia.

Dictis sp. (Figs. 23-24)

Diagnosis: Females (no males available) of this species may be distiguished from the other local scytotids by the copulatory pockets which consist of heavily sclerotized, slightly dentate ridges at the lateral edge of a chitinized area.

Description: Large and massive species; total length 7.72. Carapace 3.86 long, rather high, CI = 0.48. Legs rather long; LI = 0.79. Colouration uniformly pale, apparently due to bleaching. Copulatory pockets modified, consisting of heavily sclerotized, slightly dentate ridges, with a chitinized area at their mesial side.

Distribution: Only this unique female specimen from Coetivy, without more specific data, has ever been collected from Seychelles.



Figs. 20-21. *Dictis sp.* from Coetivy. Original figure. Scale bar for Fig. 20 = 1.0; Fig. 21 = 0.5 mm. 20). Female dextrolaterally. 21). Epigyneal area ventrally.

Discussion: According to the structure of the copulatory pockets the species is close to *Dictis striatipes* L. Koch, 1872. However, without a full revision of the genus *Dictis* it is not possible to identify the present specimen more accuratelly.

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NOTES

Keys to the Seychelles Fauna: 3. Myriapods

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Myriapods (centipedes and millipedes) are abundant in Seychelles. 50 species have been recorded on the granitic islands, of which 19 are believed to be endemic. The origins of the remaining 31 are not clear; some may be introduced. The millipedes are important detritivores, especially in the case of the giant millipede *Seychelleptus seychellarum* (Desjardins, 1834). The centipedes are signifcant invertebrate and small vertebrate predators. Although the majority of their food items are likely to be invertebrates, *Ballonema* sp. has been recorded killing and eating a frog (*Sooglossus gardineri* Boulanger, 1911) (P. Matyot *pers. comm.*) and giant centipedes *Scolopendra subspinipes* (Leach) have been seen eating skinks (*Mabuya wrightii* Boulanger, 1911) (M. Betts *pers. comm.*).

The key is based on adult specimens and identification of juveniles should be attempted cautiously. Species names are followed by distribution records with dates of first and last records and island abbreviations: M = Mahé, SA = St. Anne, V = Isle aux Vaches Marines, S = Silhouette, P = Praslin, A = Aride, Co = Cousin, Coe = Cousine, Cur = Curieuse, Mar = Marianne, D = La Digue, F = Fregate.

A.	Each segment with one pair of legs	Chilopoda (centipedes) - B.
	Each segment with two pairs of legs	Diplopoda (millipedes) - C.

B. - Centipede Key:

1.	Body extremely long and thin	2. (Geophilomorpha)
	Body not extremely long & thin	6.
2.	Approximately 50 segments	3.
	Approximately 100 segments	16.
3.	47-57 segments, head L=2W	4. (*Mecistocephalus* spp.)
	41-45 segments, head L=W	*Nesogeophilus leptochilus* (M1972-96, P&Cur1972)
4.	47 segments	*M. angusticeps* (P&Cur 1972)
	49 segments	5.
	51 segments	*M. sechellarum* (S 1972-94)
	57 segments	*M. cyclops* (? 1894)

NOTES

5.	No clear pattern	*M. vanmoli* (M 1972)
	Long dark stripes	*M. punctifrons* (M 1874-1972, S&P 1972)
6.	Legs relatively short	7.
	Legs & antennae extremely long	*Ballonema* sp. (M 1874-96, S 1972-90)
7.	21 equal sized segments	8. (Scolopendromorpha)
	15 segments, alternate large & small	12. (Lithobiomorpha)
8.	Antennae with 15 segments	9.
	Antennae with 17-20 segments	10. (*Otostigmus* spp.)
9.	Large size (up to 25cm)	*Scolpendra subspinipes* (M 1768-1997, S 1990, A & F 1972-97)
	Small size (up to 1.5cm)	*Cryptops philammus* (M 1896-1996, S 1972-90, P & Cur 1972)
10.	Red-brown/chestnut, head dark	*Otostigmus seychellarum* (S 1896-1990)
	Yellow to green	11.
11.	21 antennae segments, 35mm	*O. rugulosus* (S 1874-1990)
	17-19 antennae segments, 70mm	*O. orientalis* (M 1874-1972, S 1972)
12.	c20 antennae segments	13. (*Lithobius* spp.)
	c30 antennae segments	*Lamyctes albipes* (M&P 1972)
13.	Violet tint present	14.
	No violet tint	15.
14.	Pale brown -	*Lithobius inflatitarsus* (M & S 1908)
	Dark brown -	*L. sechellarum* (M 1894-1996, S 1908-90)
15.	Less than 1cm long	*Lithobius abbreviatus* (M 1908)
	More than 1cm long	*L. semperi* (M & S 1972)
16.	Head width equal to length	*Thalthybius melanostigma* (M 1896-1972)
	Head length 1.5 times width	*Tyggarup javanicus* (M & P 1972)

NOTES

B. - Millipede key:

1.	Does not form a sphere	2.
	Curls up into a sphere	*Cyliosomella furciparum* (M 1994, S 1972-97, Mar 1874)
2.	Flat-backed	3.
	Rougly circular in cross-section	11.
3.	Rostrum present, antennae club-like, >30 segments	4. (Polyzoniida)
	No rostrum, antennae not club-like, up to 30 segments	7. (Polydesmida)
4.	Rostrum reaches 3rd antenna segment	5. (*Rhinotus)*
	Rostrum reaches 4th antenna segment	6.
5.	Yellow, dark dorsal stripe	*Rhinotus crassiceps* (M&S 1896-1996)
	Pale brown, long legs, hairy	*R. vanmoli* (S 1972)
	Brown, white head	*R. albifrons* (P 1972)
6.	White	*Siphonophorella braueri* (juvenile)
	Pale grey (33 segments)	*S. silhouettensis* (S 1972)
	Reddish brown (63-73 segments)	*S. braueri* (M 1972-96)
	Brown (55-72 segments)	*Pterozonium tropiphora* (M 1896-1972, S 1972-90, P 1896, F 1972)
7.	Approximately 20 segments	8.
	28 segments	*Hyperothrix urophura* (M 1896-1972, S 1972)
8.	Not hairy	9.
	Short hairs on all segments	*Cylindrodesmus hirsutus* (M 1896-1972, S&P 1972)
9.	Keel a simple flange	10.
	Keel a projecting spine	24.
10	Well developed keel	22.
	Very short keel, small (<8mm)	*Sphaeroparia* sp. (M 1972, S 1990)
11.	<10 cm long	12.
	10-30 cm long	*Seychelleptus seychellarum* (V 1994, SA 1768, S,A&D 1972-97, Coe 1996, F 1835-1997)

NOTES

12.	Pale red, yellow legs	*Seychelleptus seychellarum* (juv.; see 11.)
	Red	13.
	Brown/black	14. (Spirobolida)
13.	Pale head only	*Glyphiulus granulatus* (M 1896-1994, S 1990)
	Pale head & 1st segment	*Charactopygus atratus* (M&D1972, S1972-94)
	Pale head & 1st-4th segments	*Hypocambala anguina* (M,S&P 1972)
14.	Head and first segment white	*Benoitiulus flavicollis* (M 1972-96, S 1996)
	Head not white	15.
15.	Black	16.
	Brown	18.
16	Approximately 50 segments	17.
	30-40 segments	*Spirobolus praslinus* (P 1902)
17.	Telson elongated into a spur	*Eucarlia urophorus* (M 1892-96)
	Telson not elongated	*E. alluaudi* (Mar 1894, Co 1996, A 1997)
18.	Fewer than 40 segments	*Paraspirobolus dictyonotus* (M 1896)
	>48 segments	19.
19.	Dark brown, 2cm	20.
	Light brown, 3-4cm	21.
20.	>55 segments	*Trigoniulus goesi* (M 1972, S 1990, P 1996)
	48-52 segments	*Spirostrophus naresi* (M 1892-1997, Cerf 1996, S&D 1972-96, P 1996-7, Cur&F 1972)
21.	Uniform, legs yellowish	*Spiromanes braueri* (S 1972)
	Dark long stripes, legs brown	*S. seychellarum* (S 1972, A 1997)
22.	Keel notched, tubercular back	*Propyrgodesmus* sp. (M&S 1972-96)
	No notches, brown, keel yellow	23.
23.	Upto 30mm long, broad (3-6mm)	*Chondomorpha xanthotricha* (M 1972-96)
	<20mm, narrow (2mm)	*Orthomorpha gracilis* (M 1894-1997, Cerf & P 1996)
24.	Keel spine toothless	*O. crinata* (M 1896-1996)
	Keel spine toothed	25

25. Pointed tubercles, yellow-brown *Pratinus planatus* (M&P 1972-96, S1972-90)
    No dorsal tubercles, dark brown *O. coarctata* (M 1894-1996, P 1894-1996, Cur & F 1972, D 1894)

Status & Conservation

Of the above species the majority are known from only scattered records. Two species have not been recorded this century (*Mecistocephalus cyclops* and *Paraspirobolus dictyonotus*) and three only in 1902 (*Spirobolus praslinus*) or 1908 (*Lithobius inflatitarsus* and *L. abbreviatus*). Further searches for these species are required. Three species appear to have decline on some islands. the pill millipede *Cyliosomella furciparum* was collected on Marianne in 1874, where it now appears to be extinct, but survives in mist forest on Mahé and Silhouette. Its historical presence on the low, relatively dry island of Marianne is puzzling and can only be explained following research into the ecology of this species. Similarly *Eucarlia alluaudi* was known only from Marianne in 1874 until it was rediscovered on Cousin in 1996 and Aride in 1997. On the latter island it is abundant in damp areas and appears to be associated with marsh habitats on sea-bird islands. The giant millipede *Seychelleptus seychellarum* is identifiable in the reports of the Marion Dufresne expedition in 1768 (Gerlach 1995) when it was noted on St. Anne. This population is now extinct. The presence of the species on small islands of the Mahé and Praslin groups indicates that it probably used to inhabit both Mahé and Praslin. Its extinction on these islands may be attributable to predation by tenrecs (*Tenrec ecaudatus*) which are present on Mahé and Praslin but not on the large islands where the giant millipede survives (Silhouette, La Digue and Fregate).

It has been suggested that the unidentified species *Propyrgodesmus* sp. and *Sphaeroparia* sp. are introductions. Both are Asiatic genera and it is possible that their presence in Seychelles may be indicative of Gondwanan origins. Until they have been properly identified it is probably best to consider them as possibly native species.

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NOTES

Recent natural colonisation of the granitic islands by three bird species

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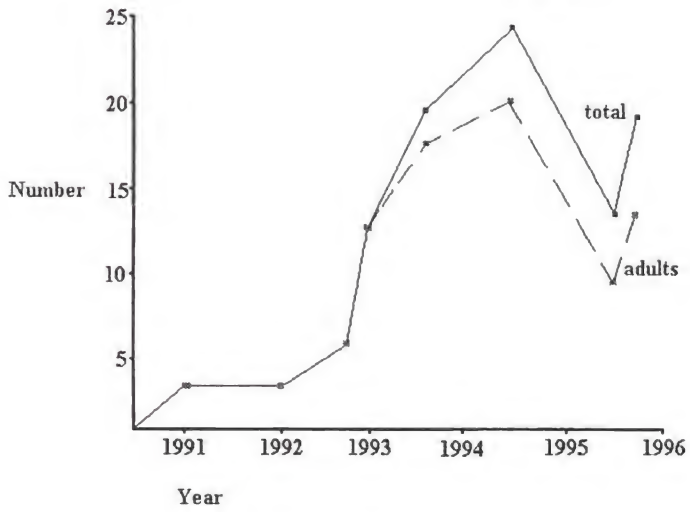
Colonisation of new areas is an important part of the evolution of island biotas but is very rarely observed. Many Seychelles bird species are assumed to be relatively recent colonists but all except for the introduced species seem to have been well established by the time the first ornithologists visted the islands. It is generally assumed that the most recent colonist is the Chinese bittern (*Ixobrychus sinensis* (Gmelin, 1788)) which was first observed in 1867 (Benson 1984) and appears to have expanded its range since that date. Recent close monitoring of bird species has revelaed the natural colonisation of the graintic islands by grey herons *Ardea cinerea* Linnaeus, 1758 in 1992. The process of colonistaion is described below followed by discussions of two further possible natural colonisations; black-crowned night herons *Nycticorax nycticorax* Linnaeus, 1758 and rose-ringed parakeets *Psittacula krameri* Scopoli, 1769.

Grey herons

Grey herons, being a cosmopolitan species, are found throughout the western Indian Ocean. Historically they were recorded as being present on the granitic islands of Seychelles and were even at one time kept tethered in some gardens for later consumption by the captors (Penny 1974). Over-exploitation, drainage of coastal marshes and reclamation of coastal mudflats led to the disappearance of these birds on all the granitic islands. In the 1970s and 80s they appeared to be a vagrant species and were recorded as such (Feare & High 1977).

Conditions deteriorated for the herons in 1970-72 when the first stage of reclaiming land from the sea covered a large expanse of mudflats that extended from the shoreline along the full length of the then "Long Pier" - the access road to the landing stage and slipways at the pier end. Further reclamation on a much larger scale took place in 1986-87 when the area from Victoria to the airport was reclaimed. This development project was designed to create a series of channels and lagoons between the reclamation and the natural shoreline thus allowing those owners of shore front properties to retain their link with the ocean. The natural colonisation of these lagoons by mangroves (*Rhizophora mucronata* Lam. and *Avicennia marina* (Forssk.) Vierh.) and the evolution of sand bars and new areas of tidal mudflat compensated for the areas lost in earlier developments.

Fig. 1. Grey heron numbers on Mahé 1991-96



The appearance of grey herons in 1991 was at first recorded as the sighting of a vagrant species. The three birds seen did not however depart with the migrants in April and were seen to be breeding on 30th August 1992 (R. Gerlach 1992). The breeding colony which was in the main cattle egret *Bubulcus ibis* (Linnaeus, 1758) colony at Mont Fleuri was regularly monitored and an annual census was instigated (Gerlach 1993). In September 1995 a second breeding colony of egrets and grey herons was recorded on Hodoul island in Victoria harbour (R. Gerlach 1995b) and in 1996 the annual census was abandoned because of the wide dispersal of the herons across Mahé and to the neighbouring islands of Praslin, La Digue and Silhouette, with occasional signtings on Cerf and Cousin (R. Gerlach 1994, 1995a&b; Matyot 1996). The census results are shown in Fig. 1. At present breeding has only been confirmed in the two colonies on Mahé but frequent sightings on Praslin and the continuous presence of herons on Silhouette for over a year suggests that new colonies may be formed in the very near future.

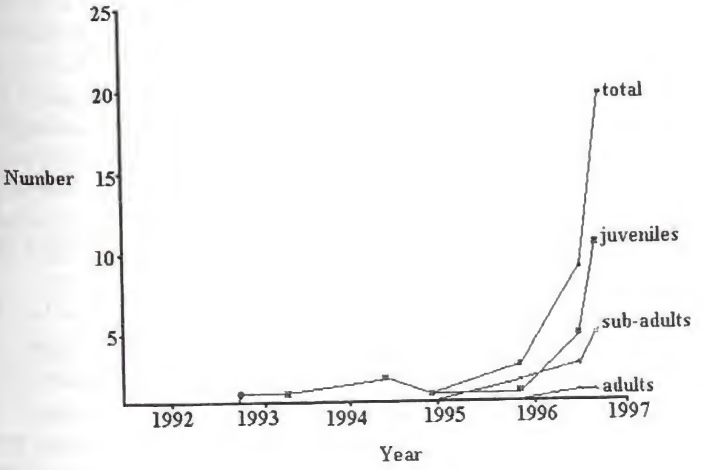
Black-crowned night herons

The changing conditions along the shoreline of the east coast of Mahé described above have also created an environment suited to another cosmopolitan species which had never been recorded in Seychelles; the black-crowned night heron. One of the most important contributions to the establishment of this species

was the creation on the reclaimed land of the Roche Caiman Bird Sanctuary. Although the sanctuary is landlocked and is only 2.9 hectares in extent, its wooded surround with areas of permanent water attracted the first night-heron ever recorded in Seychelles, an immature bird recorded on 29th October 1992 (Skerrett 1993). As with the early sighting of grey herons, the first records of night herons were assumed to be vagrants (Skerrett 1996).

Regular sightings of immature birds were made from that date, with two seen in October 1994 (Skerrett 1996). Towards the end of 1995 a group of three night herons in sub-adult plumage were seen at Roche Caiman with one bird in immature plumage. From that date, night herons have been recorded throughout the year (1996 and into 1997). The most significant number recorded to support the assumption of a natural colonisation event was on 17th August 1996 when 19 birds were recorded at North-east Point (R. Gerlach 1996). Sightings have also been made at various places around Mahé and on Silhouette. To date no breeding site has been discovered but the age structure of the birds seen in August 1996 indicates that a small nucleus of breeding adults exists. In December 1996 and January 1997 the number of sub-adults recorded increased as the number of immature birds decreased. This coincided with the first record of adults in December 1995, indicating a seasonal moult. The observations are summarised in Fig. 2.

Fig. 2. Black-crowned night heron numbers on Mahé 1992-6



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Rose-ringed parakeets

Historically Seychelles supported a parakeet species (the endemic subspecies of Alexandrine parakeet, *P. eupartira* Linnaeus, 1758 *wardii* (Newton, 1867)) which was driven to extinction by 1905 (Lionnet 1984). Sightings of ring-necked (rose-ringed) parakeets on Mahé over the past 23 years have always been assumed to relate to escaped cage-birds. Records of a 'Green Madagascar Parakeet' (Riley & Percy 1958) refer to the failed introduction of grey-headed lovebirds *Agapornis cana* (Gmelin). Parakeet sightings were made on Mahé in the area between Union Vale and Pointe Conan and at St. Louis and recently a single bird has been recorded on Silhouette (Matyot 1996).

Current records date from 1974/5 when two birds were recorded at Pointe Conan and Union Vale (R.&G. Gerlach & F. Butler-Payet *pers. comm.*). Two birds were recorded regularly at St. Louis in 1987/8 (A. Skerrett *pers. comm.*). The most recent sightings are of a single bird on Silhouette since May-June 1995 (Matyot 1996) and up to five birds on Mahé (Pointe Conan). In February 1997 a male was seen feeding in a cultivated guava (*Psidium guajava* L.). The black, red and blue collar and blue cheeks and nape identified it as *P. k. borealis* Neumann, 1915 from the north of the Indian subcontinent (Cramp 1985). Five birds have been seen at Pointe Conan with three having short tails indicating that there are a pair and three juveniles (G. Adam *pers. comm.*). The origins of these birds are uncertain. The general assumption that they are escaped cage birds is not supported by the veterinary department's records which show that no permits have ever been issued for *Psittacula* (P. Boudane *pers. comm.*). However imports are known to have occurred as shown by the observation of two yellow parakeets seen in a cage at the Jardin du Roi (R. Lucking *pers. comm.*). Illegal importation is also a possibility. With approximately ten years between each record, it seems unlikely that three separate escapes can have occurred. The Silhouette record must also cast some doubt on this theory. Accidental introduction by birds arriving on ships is possible and is the probable route by which Indian house crows *Corvus splendens* Vieillot, 1816 colonised Seychelles prior to their apparent extinction (Feare & Watson 1984).

Psittacula are not known to undertake regular migrations but *P. krameri* has a scattered distribution, due to introductions and occasional range expansions (Cramp 1985; Ripley 1961). That these range expansions can extend as far as the western Indian Ocean is shown by the presence of endemic *Psittacula* descended from Asian species (*P. eupatria wardii* in Seychelles and the different species of *P. krameri* descendants in the Mascarenes). From the distribution pattern of wild parakeets and the frequency of Asiatic vagrants recorded in Seychelles it is possible that the present records represent natural colonists. The most likely interpretation of the records is that colonisation by one or two birds of the same sex has taken place in the past. In 1995 the opposite sex arrived, enabling a breeding pair to establish. Evidence for natural colonisation is more speculative than for the heron species but should be considered as valid in the event that the present population becomes

permanently established. The presence of rose-ringed parakeets in Seychelles fills the ecological niche made vacant by the extermination of the Seychelles parakeet. The ecological roles of the different *Psittacula* species are very close and differences are restricted to dietary separation as a result of different bill sizes. Bill lengths of museum specimens of Seychelles parakeets (24-34mm) are intermediate between *P. eupatria* (32-42mm) and *P. krameri* (21-25mm). Consequently either species would be appropriate ecological replacements for the extinct Seychelles form. Details of the Seychelles parakeet's ecological role are limited to brief notes on the behaviour of captive birds (Lionnet 1984) and the Kreol name for the tree *Brexia madagascariensis* (Lam.) Ker Gawl. ('bwa kato') which implies that its fruit was consumed by parrots. It has not been recorded as a component of the diet of the extant black parrot *Coracopsis nigra* Linnaeus, 1766 and the name probably refers to the green parakeet. This tree species is now very rare which may be partly the result of the loss of a signifcant dispersal agent. The only way to determine the significance of parakeets in the ecosystems of Seychelles is to monitor the current process of establishment of rose-ringed parakeets. If a viable population develops as a result of this colonisation this could restore a significant part of the natural seed dispersal and pollinator niche which is essential to the preservation of the islands' ecosystems (J. Gerlach 1997).

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NOTES

New records of freshwater leeches

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There is only one published record of freshwater leeches in Seychelles, that is to *Barbronia weberi* (Blanchard, 1897) from an unspecified locality (High 1974). In 1989 a species of aquatic leech was found in the Rivière Mare Angalise on Mahé, this was assumed to be *B. weberi* but was not identified or collected. In July-August 1996 aquatic leeches were collected at the same site and have been identified as two species: *B. weberi* and *Glossiphonia complanata* Linnaeus, 1758.

***Barbronia weberi* (Blanchard, 1897). Family Erpobdellidae**

2 adults and 1 juvenile collected from the Rivière Mare Anglaise, Mahé on 9th August 1996 (NPTS V1996.1). Present on dead leaves in slow flowing lower parts of the river. Largest specimen measuring 25mm extended live length (19mm preserved). The segmentation is very indistinct, four pairs of eyes are arranged round the head. The body is long and thin. The anterior sucker is indistinct, the posterior well developed. Live colouration is red-brown to orange with two blood red longitudinal lines. Also located at Anse Intendance.

This species is from south-east Asia (the type is from Java), the Philippines and India. It is a scavenger on animal remains and a predator on molluscs, worms and insects. It is almost certainly a recent introduction to Seychelles.

***Glossiphonia complanata* Linnaeus, 1758. Family Glossiphonidae**

4 adults collected from the Rivière Mare Anglaise, Mahé on 31st July 1996 (NPTS V1996.2). Present on dead leaves in fast flowing upper parts of the river. Largest specimen measuring 15mm extended live length. The segmentation is distinct, 1-2 pairs of eyes are present, clustered together on the head. The body is broad, not elongated. Both anterior and posterior suckers are distinct. Live colouration is beige with a medial brown longitudinal line, two lateral pale brown longitudinal lines with a black line between the medial and lateral lines. The black lines fade posteriorally; the posterior of the body is marked with 5-6 brown lines. This pattern corresponds to the form described as *G. concolor* Apáthy, 1888.

This species is a snail predator with a wide distribution in north America, Europe, Asia and Africa. It is almost certainly a recent introduction to Seychelles.

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NOTES

Oecobiids of the granitic islands of Seychelles (Araneae, Oecobiidae).

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Key words: *Maitreja*, Oecobiidae, Seychelles

Abstract: In this paper it is shown that *Oecobius reefi* Saaristo, 1978 = *Maitreja marathaus* (Tikader, 1962), *n. syn.*, and that the species reported from Mahé by Benoit (1978) under the name *Oecobius cellariorum* is also that species.

Introduction

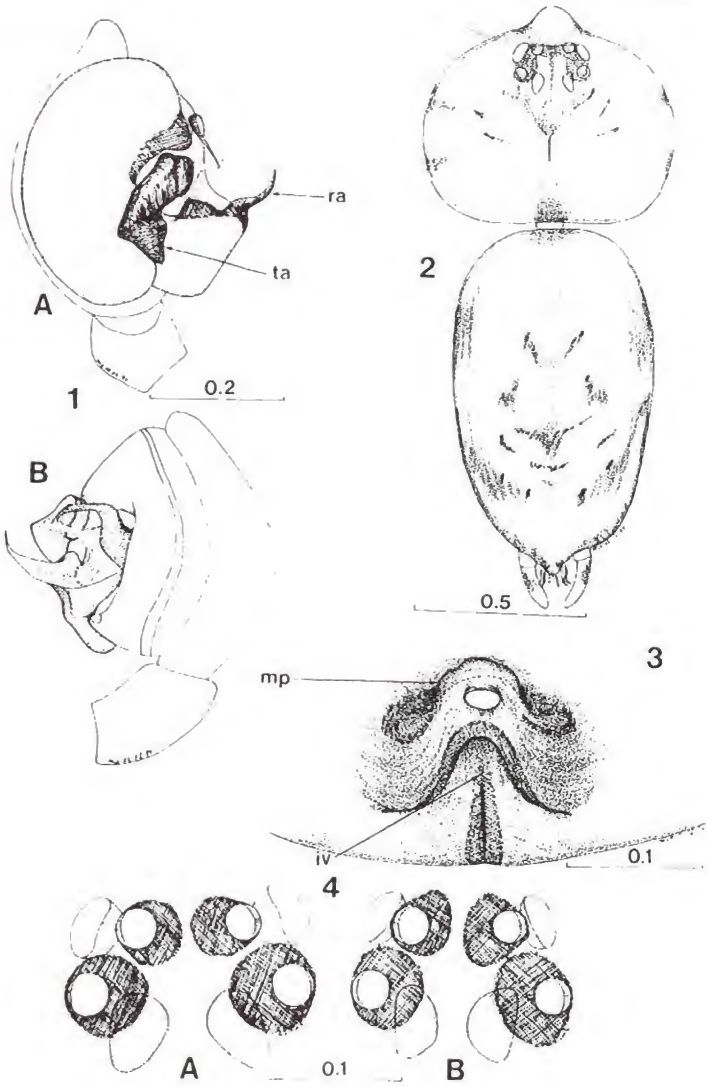
The spider family Oecobiidae is characterized by the remarkable anal tubercle which is large, movable and two-jointed. It is fringed around its base with long, simple, sinuate hairs and apically tipped with long sensory hairs. The carapace is usually wider than long, somewhat flattened, as is the abdomen, which is elongate or suboval and somewhat pointed behind. Legs are relatively long, laterigrade. The cribellum is present in Oecobinae and absent in Urocteinae; only members of the former subfamily have been found in Seychelles.

Genus *Maitreja* Lehtinen, 1967

Maitreja Lehtinen, 1967: 246. - Type species by original designation and monotypy *Oecobius marathaus* Tikader, 1962 from Calcutta (India).

Diagnosis: The genus is most easily recognised by the median, anteriorly pointing, pit bearing, lip-like median protrusion of the epigyne

Description: As this is a monotypic genus its description is covered by that of the type species.



Figs. 1-4. *Maitreja marathaus* (Tikader, 1962). Original figures, scale bars in millimetres. 1) Left male palp mesially (A) and ectally (B) (type of *reefi*). 2) Male carapace and abdomen dorsally (type of *reefi*). 3) Epigyne ventrally (MZT 143.258). 4) Eye pattern of male (A = type of *reefi*) and female (B = MZT 143.258).

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Maitreja marathaus (Tikader, 1962) (Figs. 1-4)

Oecobius marathaus Tikader, 1962: 684 (female).
Maitreja marathaus, Lehtinen 1967: 246, f. (female; n. comb.).
Oecobius reefi Saaristo, 1978: 104, f. 46-51 (male) **New synonymy.**
Oecobius cellariorum, Benoit 1978: 679 (misidentification).

Diagnosis: The male of this species may be distinguished from all other oecobiids by an unbranched, slightly sinuous, blunt-tipped terminal apophysis (ta) and sharply pointed radical apophysis (ra) (Fig 1). In the epigyne of the female there is a fairly deep median atrium-like invagination (iv) followed by an anteriorly pointing lip-like median protrusion (mp) bearing a pit (Fig.3).

Description: The male of this species has been well described by Saaristo (1978, as *Oecobius reefi*). The female is essetially like the male but with slightly larger eyes (Fig. 4).

Distribution: The species has been recorded from India (Tikader 1962) and Seychelles: Mahé (Saaristo 1978 as *Oecobius reefi* and Benoit 1978, as *Oecobius cellariorum*).

Discussion: Since its original description the species has been known only from the female holotype. As I (Saaristo 1978) had collected only one male specimen from Mahé I was unable to connect it with *Maitreja marathaus* and accordingly described it as a new species. On the other hand, Benoit (1978) reported a female of *Oecobius cellariorum* also from Mahé. I have seen that specimen and it turned out to be a female of *M. marathaus* (MZT 143.258).

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NOTES

Two additions to the insect fauna of Seychelles

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1. *Achaea klugii* (Boisduval, 1833)
(Lepidoptera, Family Noctuidae, Subfamily Catocalinae)

In his monograph on Seychellois Lepidoptera, Legrand (1965) lists only two species of *Achaea* from Seychelles: *A. catella* Guenée, 1852 and *A. mercatoria* (Fabricius, 1775). I have observed a third species, identified by me as *A. klugii* (Boisduval, 1833), on several occasions hovering around lights at night inside a house in Marie Laure Estate (Bel Ombre district) on Mahé, at around 90 metres above sea level. This species differs from the other Seychelles *Achaea* spp. by its mostly yellow hind wings and overall yellowish tinge on the rest of the body.

The dates of most sightings were not recorded, but one such observation was made on 3rd January 1995. On 30th January 1997 Katy Beaver and Lindsay Chong-Seng discovered a moth answering to the description of *A. klugii* in a similar situation close to the coast at L'Îlot (Glacis district).

According to Guillermet & Guillermet (1986) this species occurs in Réunion, Mauritius and Madagascar as well as on the African continent. With this distribution it may be a recent natural colonist in Seychelles.

2. *Thea variegata* (Fabricius, 1781)
(Coleoptera, Family Coccinellidae, Tribe Psylloborini)

Sicard (1912) mentions 14 species of ladybird recorded from Seychelles. Vesey-Fitzgerlad (1953) adds 7 more species, most of them introduced as biological control agents to combat coccids. Surprisingly, Géry (1991) mentions only those species listed by Vesey-Fitzgerlad (1953) and makes no reference to Sicard (1912).

Another species must now be added to the coccinellid faunal list of Seychelles. This is *Thea variegata* (Fabricius, 1781), a ladybird previously known from Madagascar, Mauritius, Réunion and the African mainland (Chazeau *et al.* 1974) and is perhaps a recent natural colonist. It differs from other Seychelles ladybirds by its black markings on a yellow background (Fig. 1.).

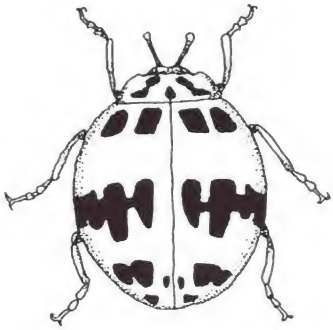

Fig. 1. ***Thea variegata***

It was discovered by Dominique Moustache in August 1996 on the underside of leaves of *Carica papaya* Linn., 1753 growing in a garden at Forêt Noire (Mont Fleuri district) on

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Mahé. The insects were still present on the same trees in March 1997.

Chazeau *et al.* (1974) report that this ladybird feeds on the fungus *Oidium* sp. and that in Réunion large numbers are found on the underside of *C. papaya* leaves on which this fungus occurs.

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NOTES

Further records of jewel beetles (Coleoptera: Buprestidae) from Seychelles

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The state of knowledge regarding the Buprestidae of Seychelles was summarised in a previous account (Matyot 1996). The following observations, most of them accumulated over the past year, should improve understanding of the distribution of several species.

1. *Belionota prasina* Thunberg, 1789

This species is now known to occur on Praslin island as well. On 9th August 1996 Catherine and Michel Claveau discovered a specimen on a felled tree

by the roadside at Anse Lazio (exact locality unknown). This is the first record of a buprestid from Praslin.

2. *Iridotaenia mahena* Farimaire, 1891

The following records provide further evidence that this species frequents secondary vegetation on Mahé, including in the vicinity of the urban environment of Victoria:

10th July 1996: a specimen was seen at around 2pm, on the ground on a wooded slope at Hermitage, to the west of Victoria hospital (35m above sea level).

9th August 1996: a specimen was found at around 11am on the ground on a wooded slope between La Rosière and Rivière Anglaise (20m).

6th October 1996: a dead specimen was found on a path in a wooded locality between La Rosière and Mont Buxton (20m).

Brauer found this species from June to July in a cultivated area of Mamelles on Mahé (Kolbe 1910)

3. *Chrysobothris dorsata* Fabricius, 1787

The following record was left out of my previous account (Matyot 1996):

7th July 1994: a specimen was caught at light in a flat near the coast at Anse Nord-Est, Mahé.

Brauer caught this species, too, in a cultivated area of Mamelles on Mahé (Kolbe 1910).

4. *Dicercomorpha alluaudi* Kerremans, 1893

There are two further records of this species from Mahé:

21st March 1996: a specimen was observed at around 11am on a *Terminalia catappa* L., 1767 tree, on the upper surface of a leaf two metres above the ground, near the coast at Anse aux Courbes.

29th January 1997: Katy Beaver found a specimen on the sand beneath a *Calophyllum inophyllum* L., 1753 near Port Glaud church.

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Water lettuce (*Pistia stratiotes*) - a new invader

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In 1996 a new threat to the fresh-water ecosystems of Seychelles was recognised when water lettuce, *Pistia stratiotes* L. was found to be dominating the Mare Soupape on La Digue. Surveys of marsh sytems carried out in July-September 1996 located the species on Mahé (Noth-East Point and Anse Forbans) and Praslin (Anse Kerlan). From anecdotal reports it appears that this species was introduced as an ornamental water plant and was first noted in the wild on La Digue in 1993, since when it has spread rapidly.

Precise data on its spread are lacking but observation made on La Digue in 1996 give an indication of its rate of spread. In January 1996 it was very localised on the Mare Soupape which was being invaded by water hyacinth, *Eichhornia crassipes* (Mart.) Solms-Laub. In July 1996 the entire marsh surface was smothered by water lettuce which was starting to move up streams. In 6 months it had spread to cover 7.03 hectares, a rate of 1.2 hectares per month. Unlike water hyacinth it is not completely restricted to fresh-water and demonstrates a remarkable degree of salinity tolerance with a well defined limit at a condutivities of 1900-2000µS.

The effect of this blanket cover of the Mare Soupape has been the complete collapse of the marsh ecosystem. Complete surface cover has resulted in light elimination and deoxygenation of the water, leading to death of all water plants and to stagnation. This process has killed all the aquatic fauna with the exception of three taxa able to breathe surface water; a hydrophilid beetle, mosquito larvae and the introduced pond snail *Gyraulus mauritianus* (Morelet, 1876). Fish and terrapins are now restricted to the streams which offer suboptimal conditions. Even the vigorously invasive water hyacinth has been virtually eliminated. The consequences of this ecological collapse spread to adjacent areas as the marsh provided a breeding ground for a much of the invertebrate fauna and invertebrate numbers in woodland have crashed. This is likely to have adverse effects on the Seychelles black paradise flycatcher *Terpsiphone corvina* Newton, 1867 and on the Seychelles shath-tailed bat (*Coleura seychellensis* Peters, 1868). This latter species has decline in recent years and active roosts are known only from Silhouette and LA Digue. On La Digue the newly located roost in the bed of the Rivière Quinon is occupied by bats which rely on the Mare soupape as a major feeding ground. This roost is likely to be abandoned in the very near future as a result fo the ecological collapse of the Mare Soupape. A full discussion of the effects of water lettuce invasion of the Mare Soupape was published in 1996 (Gerlach 1996) including data demonstrating the collapse of the woodland invertebrate populations in that year. The ecological

collapse of the plateau marsh on La Digue that has been demonstrated to have occured in 1996 is almost certain to be repeated in other areas invaded by water lettuce.

The spread of this species threatens all the marshes on Mahé, Praslin and La Digue. In January 1997 it had invaded the Rivière Mare Anglaise on Mahé but had disappeared from Anse Kerlan, Praslin. The cause of this disappearance is not known. In the same month the Scouts and Division of Environment started a trial clearance at North-East Point. This was successful in clearing a small area but demonstrated that manual clearance is not pracitcal for the larger areas. In other countries where this species has been a problem biological control has been applied successfully and the possibilities for its use in Seychelles should be investigated.

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Seychelles whale shark tagging project - pilot project report

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Introduction

This report details the first whale shark (*Rhincodon typus* Linnaeus, 1756) tagging project to be undertaken in Seychelles between 9th-23rd November 1996. The project was conceived by Marie Levine, Executive Directory of the Shark Research Institute and David Rowat, Chairman of the Association of Professional Divers, Seychelles (APDS) and conducted under the auspices of the Shark Research Institute. Its implementation was a co-operative effort between Andrew Gifford, Director of the Shark Research Institute, South Africa and Project Director of the Institute's Tagging Programme, members of the S.R.I. whale shark tagging team and staff members of the Underwater Centre Seychelles, representing the APDS.

The presence of whale sharks in Seychelles coastal waters is well known but little research has been done on their populations or life history in this sector of the Indian Ocean. Global populations of all shark species are declining rapidly due to over-fishing. Although whale sharks are not commercially harvested, they are caught as by-catch in other fishing activities and in some countries (eg. India and Indonesia) they are slaughtered for their meat. Whale sharks are planktonic feeders and not considered dangerous to man, thus there was scant interest in this species until the development of the dive tourism industry. Today the economic value of whale sharks as an eco-tourism resource is well documented in areas such as the Western Australian Exmouth/Ningaloo Reef and the Sea of Cortez.

It had been agreed at a meeting of the Minister of Tourism and Transport and the APDS that research should be instigated to ascertain whale shark numbers around Seychelles. This would investigate what they are doing in the coastal waters, frequency of visits and whether they could be utilised as a sustainable eco-tourism resource. Activities were supported in part by grant aid from the Professional Association of Diving Instructors Project A.W.A.R.E. Foundation. A number of local sponsors supported the project: funding for flights and air cargo from Cable & Wireless Seychelles, accommodation provided by the Coral Strand Hotel and boats, diving and logistical support from the Underwater Centre Seychelles.

Methods

The Shark Research Institute, South Africa, began tagging whale sharks along the South African/Mozambique coast in December 1993. By November 1996

they had successfully tagged 116 sharks using tags, tagging applicators and a system of locating the sharks by aerial survey developed by the Shark Research Institute, South Africa. This has proved to be an effective method for assessing the population of the species. By tagging the whale sharks with a comparatively large, fluorescent, passive tag it is possible, though follow-up sightings, to ascertain local population sizes and short term movement patterns. Because the tags remain embedded in the thick skin of the shark, it is also possible to determine if the same sharks return to the same areas in subsequent years or seasons.

Whale sharks often bask, cruise or feed close to the sea's surface where they can be observed from boats; however, due to the low vantage point that most small boats have this can be a very inefficient method for finding the animals. the Shark Research Institute had very successfully used a micro-light aircraft for aerial location of the sharks off South Africa and Mozambique and this was freighted to Seychelles for the pilot project.

Rob Allen, the pilot of the S.R.I. micro-light aircraft and the designer of the tagging concept and associated equipment, conducted a training session with members of the Underwater Centre Staff to acquaint them with the equipment and the tagging procedures. The micro-light was used in a preliminary survey around Mahé to establish shark distribution and to co-ordinate boat movements to allow the animals to be examined and tagged. This proved to be an extremely efficient system and resulted in a high tagging rate.

On finding a shark the team would first check to see if the animal had already been tagged, either in Seychelles or elsewhere. If the shark had a tag details of the tag number were recorded and notes made of any distinguishing features for comparison with previous records. If the shark was untagged it was sexed, tagged and pertinent details recorded.

The tags are imbedded into the skin with a purpose built "Tag Applicator" based on tried and tested spear-gun technology. The tags consist of a 5cm long stainless steel head attached to a double braid of stainless steel wire which is covered by a fluorescent green plastic tubing. The plastic is printed with the tag number and the contact information for S.R.I. This is then covered in a tough, clear, heat-shrink tubing to protect the inscriptions and prolong tag life.

The tags are imbedded in the skin next to the dorsal fin in the first of the ridges which run longitudinally down the animal. This is one of the thickest areas of the skin (about 11cm in a 5m animal). Tagging is done by a snorkeller swimming alongside the shark. The applicator has a rubber stop to ensure that the tags can only be inserted to a standard 8cm depth. Once a tag is inserted, it is tested to ensure it is securely attached by a quick tug on the trailing braid.

Results

The micro-light performed preliminary survey circuits of Mahé daily between 09.00-10.00am and when weather conditions allowed. It was soon apparent that there were a good number of sharks present. Most sharks were seen in

two main areas; one in the north and one in the south. The northern group was the larger and sharks were often concentrated in a feeding aggregation between North-East Point and St. Anne island. In view of this and the ease of accessibility to the latter area, this was chosen as the preferred tagging site. Not all sharks seen were on the surface; in areas where water visibility was clear animals 15-20m below the surface could be seen.

21 sharks were tagged (which exhausted the tag supply for this pilot project). Two tags were lost in deep water through handling mistakes and two sharks were mistakenly tagged twice; these errors highlighted areas where the inexperience tagging team had to be more vigilant and were quickly remedied. Of the sharks which were tagged, a number were sighted again, mostly in the same area. During the period of the study only two unassisted boat encounters with whale sharks occurred, although every flight found 11-18 animals in the area. A single flight around Praslin on 22/11/96 found only one whale shark between Praslin and Cousin; there had been only one opportunistic boat encounter from Praslin.

Collisions with power boat propellers is a constant risk to the sharks, due to their habit of travelling just below the surface, and a number of animals had scars, cuts to the body or pieces of fins missing. Some sharks which were re-sighted a few days after their original tagging bore new marks of contact with boats.

Conclusions

In terms of the implementation of the techniques and the tagging of the sharks, the project was a great success and showed that such an operation can be successfully supported in Seychelles. It has also shown that there are substantially more whale sharks around the islands than were previously thought and consequently they could be a potential eco-tourism resource.

From the number of sharks seen form the air relative to the number tagged and the number of untagged animals entering the area on subsequent days, it appears that the population around Mahé may have been as high as 40 or more. Comparison of the aerial sightings versus the two unassisted boat encounters is also of note: from June 4th to the end of August 1996 the Underwater Centre recorded a total of 48 such opportunistic boat encounters. Assuming a similar pattern of contact this would indicate that there was a substantially larger shark population in the area at this time.

Recommendations

In view of the major differences between the aerial sightings and the opportunistic boat encounters, it is unlikely that numbers from these unassisted sightings will accurately reflect the populations around the islands. Similarly, repeat sightings of tagged animals will be sporadic at best and will provide only sketchy information of the movements or migration patterns of the sharks.

It is recommended that this pilot study be extended into a long-term project with a micro-light aircraft being based in Seychelles to conduct aerial surveys,